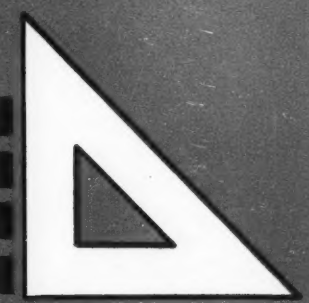
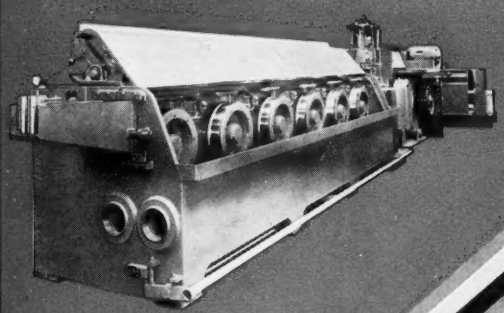
WIRE AND WIRE PRODUCTS

FEBRUARY 1954

Custom Design

by Syncro





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Outstanding Performance!

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Better Machinery for the Wire Industry

WIRE DRAWING MACHINES, STRANDERS, ANNEALERS
AND
ALLIED EQUIPMENT

THE SYNCRO MACHINE COMPANY
PERTH AMBOY, N. J., U. S. A.

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

Wilson wire annealing furnaces are now equipped with the "O" Type radiant tubes which have been so effectively used in the high convection furnaces for annealing strip coils.

The use of the "O" Type radiant tubes in wire furnaces permits greater total fuel input, offers much faster heating, better uniformity of heat application and better fuel economy.

To the rod and wire processor this means more tonnage with less tensile spread, and more uniform grain structure, at less cost, and better material for all the multitude of operations to be performed in their customer's plants with these materials.

The wire industry is almost entirely equipped with Wilson furnaces. This new firing tube makes Wilson furnaces better than ever, and best for the requirements of the wire industry.

It's time to cut costs and improve quality by replacing outmoded and inefficient equipment with the best annealing furnaces available. Let us survey your operations and recommend what will accomplish this for you!

Lee Wilson

ENGINEERING COMPANY, Inc.

20005 WEST LAKE ROAD, CLEVELAND 16, OHIO

WHAT DOES FIRTH STERLING OFFER YOU?

(ANSWER NUMBER 4)

RESEARCH THAT ANTICIPATES TOMORROW'S NEEDS

Our objective is to help *you* solve the technical and metallurgical problems of an *atomic* age *before* they arise . . . not *after*. So, at Firth Sterling, constant emphasis is on full-scale research, development, and production in specialty steels, carbides, new metals, and new methods.

Out of this determination to be ahead, not just abreast of need, has come this amazing three year record of achievement in *your* interest:

- A method of heat tinting that makes *Color Metallography* practical for determining the exact structure-property relationship of carbide mixtures.*
- New metals of great present and future potential that include heavy metal, three grades of chromium carbide, titanium carbide, and high temperature alloys.
- Cermets—those amazing hybrids of ceramic and metal, possessing in *combination* the best characteristics of each, to overcome modern technological problems.
- Zirconium—in ingot, billet, bar, rod, strip, sheet, wire, and tubing form—soon to be available for industrial applications.
- A new chemical plant, employing the most advanced processes and equipment, producing ammonium paratungstate of the highest *purity* to improve the quality of our tungsten carbides.
- Method "X"—an electro-mechanical process for machining metals that are unmachinable by conventional means.

Yes, all these are the result of "accent on research" . . . the justification for our statement

Firth Sterling Stands for Metallurgical Achievement—Past, Present, Future

*Write for reprint of article from Oct. 19, 1953 issue of STEEL.

I 4

Firth Sterling

—INC—

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C.H.Q. DIE STEEL

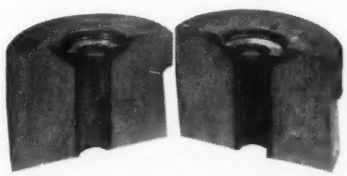
hangs up... ANOTHER COLD HEADING RECORD IN COMPARATIVE TESTS!

A nationally known fastener manufacturer* recently made comparative tests of solid steel cold heading dies, under carefully controlled conditions, producing ⅝" square head machine bolts from 1020 steel on a Waterbury Farrel double stroke automatic.

Firth Sterling C.H.Q. came off with top honors and the highest production ever

C. H. Q. solid die after 192,000 run.

obtained by this manufacturer from any steel die . . . 192,045 both ends. (78,860 one end, 59 Rockwell C; 113,185 other end, 61 Rockwell C). Standard competitive carbon steel dies produced only 50,000—60,000 both ends and ultimately failed by cracking axially. The C.H.Q. die wore oversize but longitudinally etched



Longitudinally etched section reveals no cracks.

section revealed not even a hair line crack.

Ask for technical literature on C.H.Q.—or a Firth Sterling representative will discuss your die problems. His recommendations are unbiased . . . we make and sell *both* steel *and* carbide for every tooling need.

*(name on request)

P-10

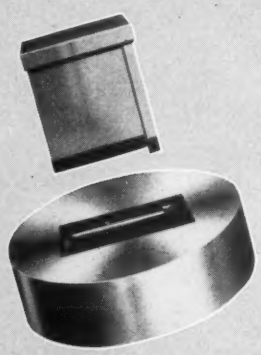
PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool & Die Steels
Stainless Specialties
High Temperature Alloys

Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets

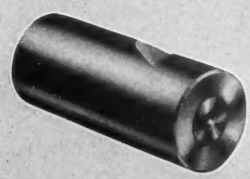
Production Records Prove *Talide Dies* Save You Money

● 137,000 hi-alloy steel Pressure Vessels deep drawn through a TALIDE Sheet Metal Die—with buffing and polishing costs cut 80%—downtime 98%—and scrap 100%. Best production from steel die used previously was 7,900 cylinders before wearing oversize.



BLANKING AND FORMING DIES

Over 5,000,000 abrasive paper discs blanked out with a TALIDE Blanking Die—70 times more than produced with hard alloy dies used previously.

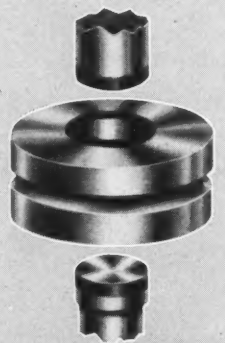


HEADING AND EXTRUSION DIES

Costly cold-heading job on 3/4" carriage bolts producing only 50,000 pcs. per steel die made profitable with average 1,500,000 piece production runs with TALIDE Cold-Heading Dies.

CURLING ROLLERS

Large Can Company reports TALIDE Curling Rolls last 65 times longer than steel rolls on beverage can forming operation—with edges free from burrs and cracks.

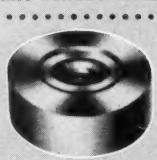


POWDER METALLURGY DIES

Large Pharmaceutical Company reports TALIDE Pill Dies not only produce tablets having a superior surface glaze which reduces rejects 82%—but also outlasts steel dies 100 to 1.

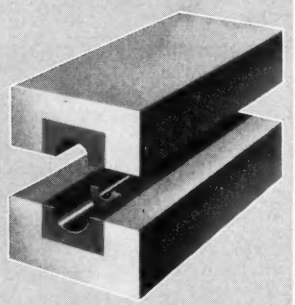
TUBE MANDRELS

12 days (36 shifts) of continuous trouble-free production obtained by eastern Brass Mill with TALIDE Tube Drawing Mandrels—compared to average 8-hr. runs obtained with steel mandrels.



DRAWING DIES

50 miles of tough 5" alloy steel tubing (actually 252,000 ft.) drawn by large midwestern Steel Mill through TALIDE Tube Die compared with a normal run of 10,000 ft. with a steel die.



SWAGING DIES

Leading Fountain Pen Manufacturer cold swages an average of 750,000 stainless steel sleeves with TALIDE Swaging Dies — 33 times more than with chrome-plated dies.

● Available in size range from .010 to 24" I.D. and in any shape, Talide Dies meet every requirement. Uniform quality and consistent performance are assured by 21 grueling tests including physical, chemical and metallographic. Send us prints or parts of your particular die application for estimate and recommendations. **Metal Carbides Corp., Youngstown 7, Ohio.**

Send for new 84-page Catalog 54-G or ask for sales engineer to call.

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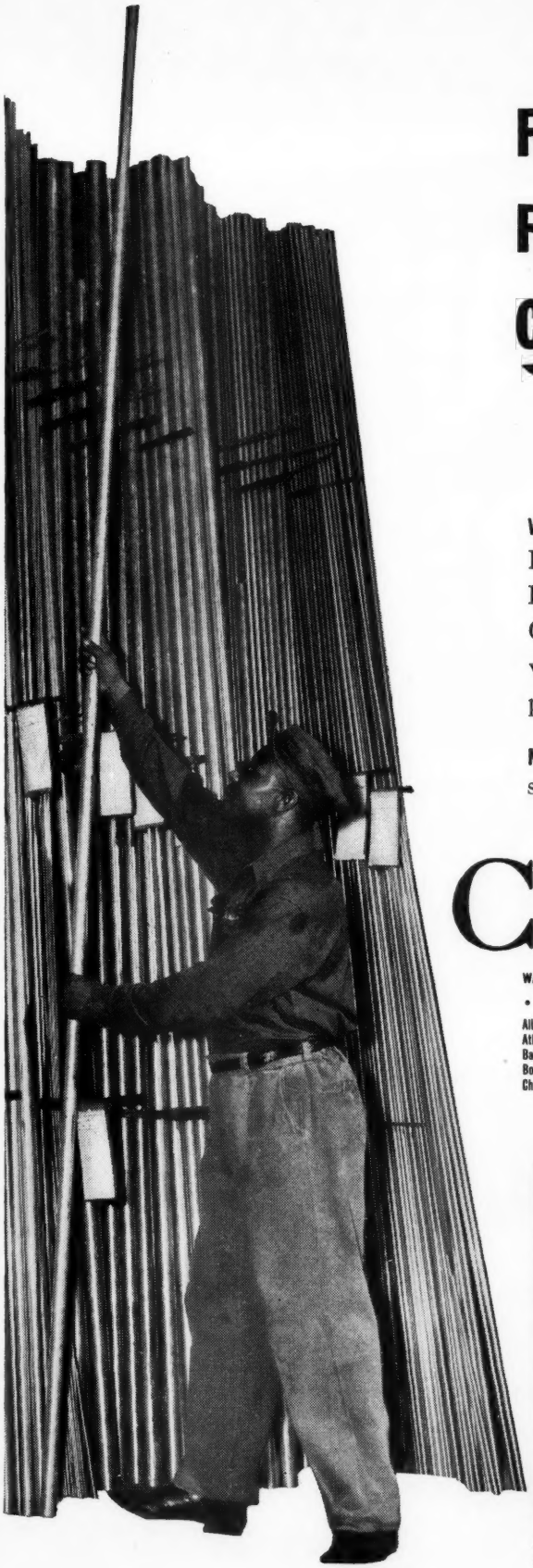

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CHASE

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Many of our branches are equipped to slit, saw, or shear our metals or your own stocks to specifications.

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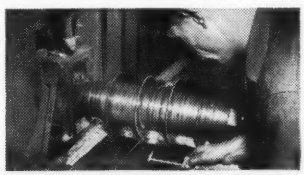


Close tolerance sawing, slitting, shearing to your specifications.

Stocks of tube, rod, bar, strip, sheet and wire in a variety of alloys.

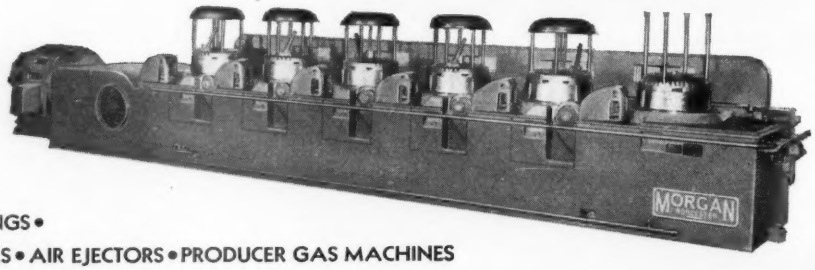
So Simple—yet so important!

AIR COOLING
Cool the wire and you can draw any grade of wire at high speeds. That's what Morgan-Connors do.

BUILT COMPACTLY
Keep the size of the wire machine to a minimum and you'll save valuable space for more machinery. That's how Morgan-Connors are built.

CONSERVES POWER
Use one motor of the right capacity and you'll not need several smaller ones. That's how Morgan-Connors save on power.

To be sure you're getting top production efficiency, ask the opinion of a Morgan engineer.



Type BW
Morgan-Connor Wire Machine

ROLLING MILLS • MORGOIL BEARINGS •
REGENERATIVE FURNACE CONTROLS • AIR EJECTORS • PRODUCER GAS MACHINES

MORGAN-CONNOR
WIRE MACHINES

WM-80

MORGAN CONSTRUCTION COMPANY • WORCESTER, MASSACHUSETTS

WIRE AND WIRE PRODUCTS*

Reg. U. S. Pat. Off.

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 29 FEBRUARY, 1954 No. 2

Designated as Official Publication By The Wire Association

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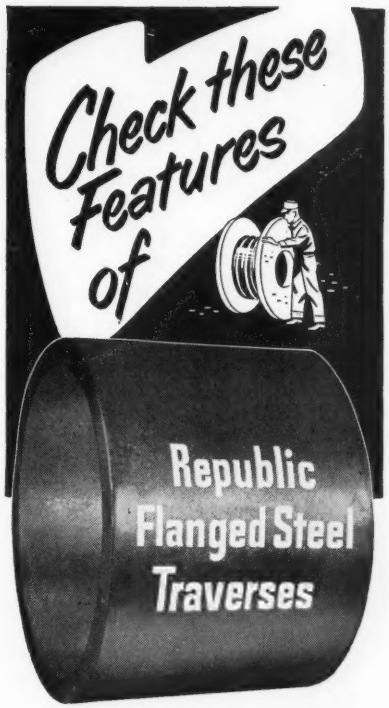

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* * *

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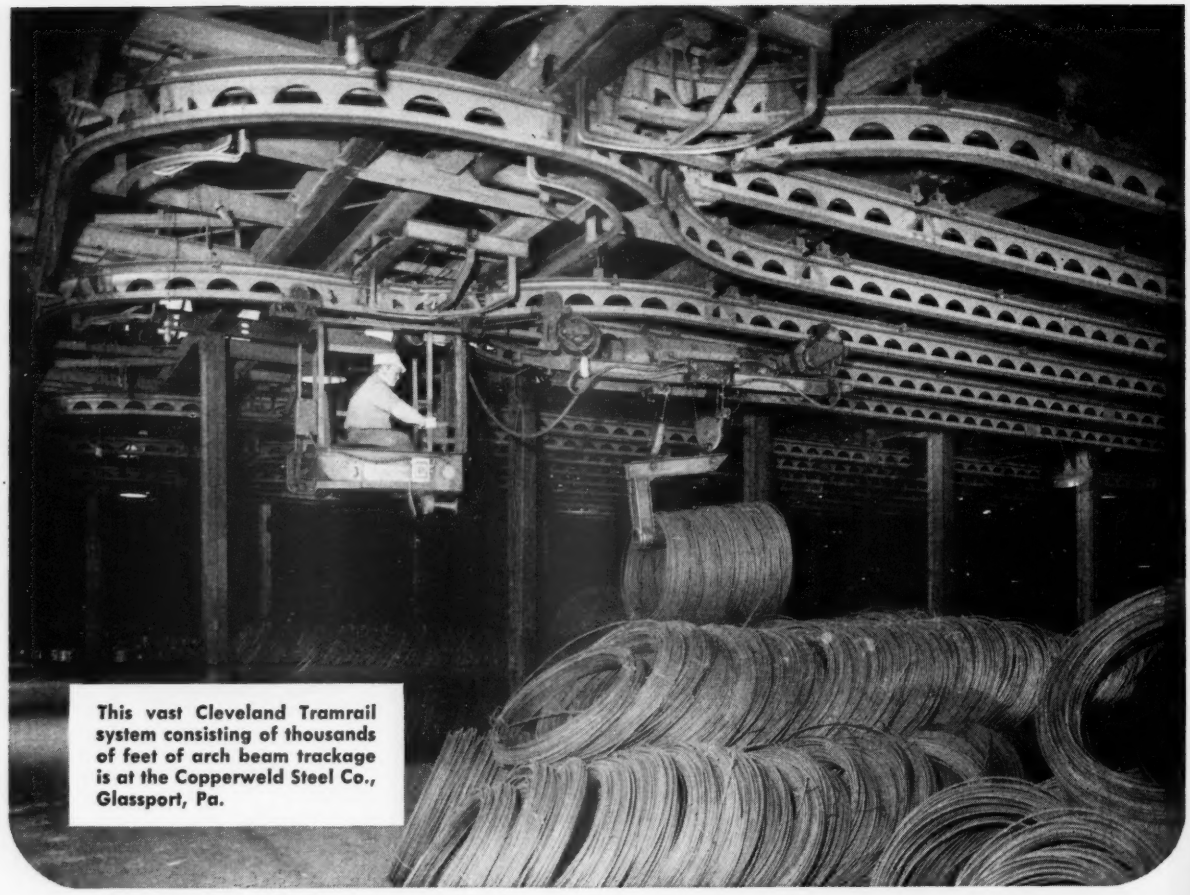

This vast Cleveland Tramrail system consisting of thousands of feet of arch beam trackage is at the Copperweld Steel Co., Glassport, Pa.

The *Most Practical* and *Lowest Cost* Method of Handling Wire and Rod

The headline words refer to overhead materials handling equipment and are powerfully strong, we admit. Yet we do not know of one engineer who is closely connected with the industry and experienced with all methods of handling, who will disagree.

Mills, large and small, from coast to coast, in the United States and Canada, have invested many millions of dollars in Cleveland Tramrail equipment to speed their wire and rod handling. The dividends that this huge investment has made possible, because of low-cost handling, have returned the original capital many times over.

If your company does not now enjoy the many benefits of Cleveland Tramrail, we urge you to get the "low-down" on what this equipment can do for you. A nearby sales engineer will be glad to give you the details without obligation.

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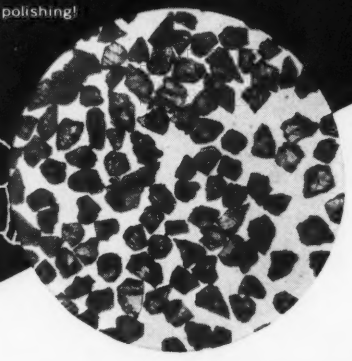

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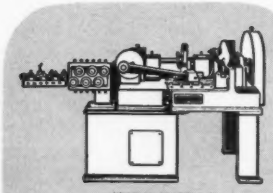
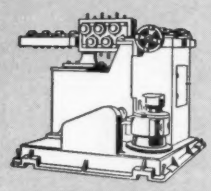


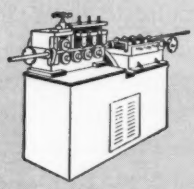
SLIDE FEED STRAIGHTENERS

3/8" x 10"; 9/16" x 10"



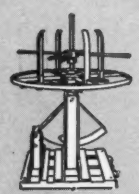
FEED STARTER AND STRAIGHTENER

Max. 5/8" dia.



TUBE AND BAR STRAIGHTENER

7/32" to 5/8" bar 1" tubing



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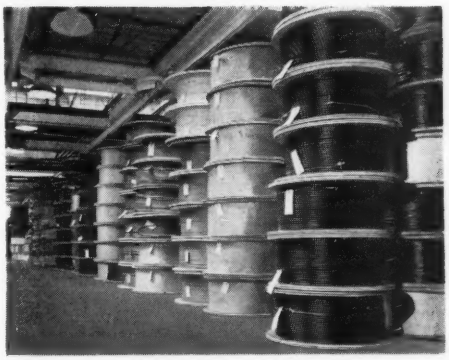
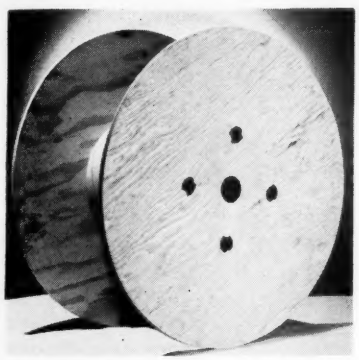
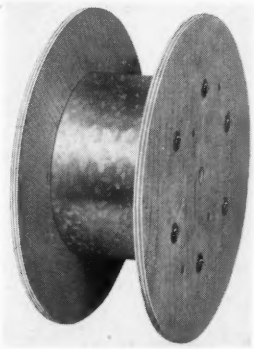
Cutting cores to length and assembling reels.



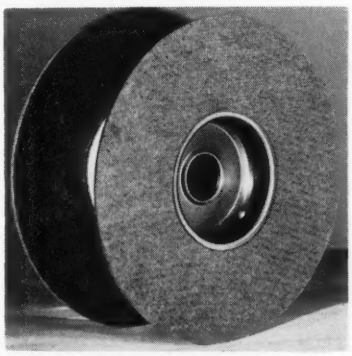
Hubbard non-returnable reels loaded and ready for shipment.



Reel with plywood flange with cardboard hub assembled with tubular rivets for non-returnable and export shipments.



Reel with plywood flange and galvanized steel hub assembled with tubular rivets and special washers for heavier loads.



Reel with masonite flange and cardboard hub assembled with steel end washers for domestic or export shipment of wire, tape, braid or other materials.

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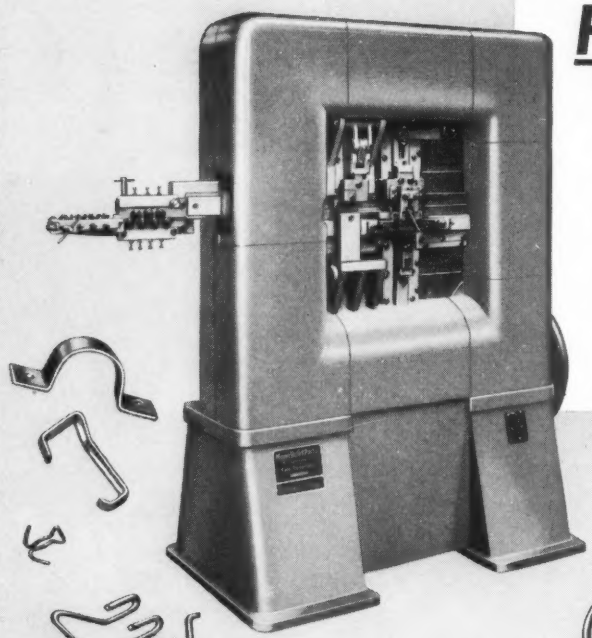

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- 3-speed drive.
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NEW! HIGH POTENTIAL Insulation Breakdown Tester

• mobile • tests to 50,000 volts • capacities to 25KVA

RELIABLY DETECTS INSULATION FAILURES — The DAVIS Hi-Pot Tester cuts off high voltage at predetermined current flow. It automatically and positively identifies insulation breakdowns and prevents damage to tested equipment. For cable, wire and other insulation requiring ratings: 2 KVA 0-2,000 volts; 2 KVA 0-3,000 volts; 5 KVA 0-5,000 volts; 7½ KVA 0-7,000 volts; 15 KVA 0-15,000 volts.

PORTABLE — A handsome, streamlined, wrinkle-finished steel cabinet only 29" high, 23" wide, and 18" deep, houses this entire mobile tester which rolls quietly on puncture-proof rubber tires.

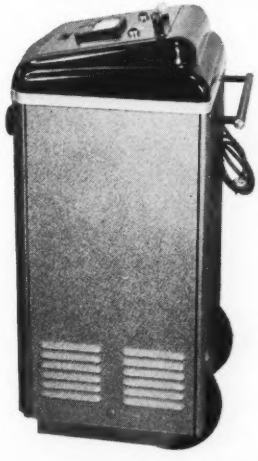
ECONOMICAL — A low center of gravity and large push-bar handle make a well balanced tester which can be easily moved wherever needed. Ideal for production budgets not permitting more than one unit.

SIMPLE TO OPERATE — Red light registers insulation breakdown. Green light indicates insulation O.K. Little or no maintenance over long usage. Ease of operation permits use of relatively unskilled help. Operates from 110 V, 220 V, 440 V, 50/60 cycles or any standard AC power line.

OFFERS MAXIMUM SAFETY — Designed to A.I.E.E. specifications, this ruggedly built DAVIS High Potential Insulation Tester provides laboratory testing accuracy for most industrial and railroad conditions. A magnetic safety switch breaks the circuit on breakdowns or overloads. The entire instrument case is maintained at ground potential. Test leads are heavily insulated and shielded to ground. Test probe handles are of thick dielectric strength material, with flash guards that prevent arc or flash burns and operator hand slippage.

BURN TESTS — Automatically creates a continuous arc at voltage and current sufficient to maintain the burn, thus precisely locating breakdown.

PLUS FEATURES — *Voltage control* is stepless continuously variable over complete output voltage range. *Voltage indicator* is easy to read, shows output voltage across test leads. Available in all standard and special KVA testers.



For full details, WRITE TO-DAY for Bulletin HPT.

Davis ELECTRIC CO.
WALLINGFORD, CONN., U.S.A.

DAVIS
WIRE & CABLE EQUIPMENT

HARNESS TESTERS ★ PAY-OFFS ★ TRAVERSES

SPARK TESTERS ★ SPOOLERS ★ TAKE-UPS ★ CAPSTANS

Correspondents throughout the world

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HERBORN

MECHANICAL SCALE REMOVING EQUIPMENT — MODEL MEA

OUTSTANDING ADVANTAGES:

- **No pickling process or acid treatment involved.**
- **Considerable cost-saving by combined de-scaling and drawing operation.**
- **Elimination of wire transports.**

MASCHINENFABRIK HERBORN

BERKENHOFF & DREBES A.-G. • HERBORN (DILLKREIS) GERMANY

Sole Agent in U.S.A.: Kurt Orban Company Inc., 205 East 42nd Street, New York, N. Y. Phone: Murray Hill 4-7700, Cables: ORBANOK, N. Y.
Sole Agent in Great Britain: P. A. Mead Ltd., 3 Vincent Parade, Finsbury Park, London, N. 4, Telephone: ARChway 2127.

INDEX 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
CORROSION RESISTANCE
RESISTANCE TO SCALING
MACHINABILITY
Crucible
NOW!
HERE'S THE ANSWER TO FAST ACCURATE SELECTION OF STAINLESS STEELS
Crucible
REZISTAL® STAINLESS STEEL SELECTOR
FOR MAKING THE MOST OF STAINLESS STEEL
NOMINAL COMPOSITION

The answer to most of your questions about stainless steels are right at your finger tips, when you use Crucible's unique new Stainless Steel Selector.

Want to know the machinability characteristics of a stainless grade? Resistance to corrosion or scaling? Physical or mechanical properties? You can get the answers to these and other questions simply by setting the arrow on the Selector slide at the proper window. It's just as quick and easy as that.

And almost as fast as you get the answer, you can get the steel you need. For many of the REZISTAL stainless steels shown on the Selector are carried in stock in Crucible warehouses conveniently located throughout the country.

To get your free copy just fill in and mail the coupon. Better do it now.

HOW THE SELECTOR WORKS:

Start with the problem. For example, resistance to corrosion in contact with copper sulfate. Just set the slide at the proper index number shown on the Selector (in this case on the back), and you have the answer in a second – grades 302 and 316 are fully resistant to this form of attack.

Crucible Steel Company of America
Dept. WW, Henry W. Oliver Building
Pittsburgh, Pa.

Name_____

Company_____ Title_____

Address_____ City_____ State_____

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **STAINLESS STEELS**

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REX HIGH SPEED • TOOL • REZISTAL STAINLESS • MAX-EL • ALLOY • SPECIAL PURPOSE STEELS

3 times the descaling capacity with only ½ the man power!

MADE POSSIBLE WITH THE MODERN

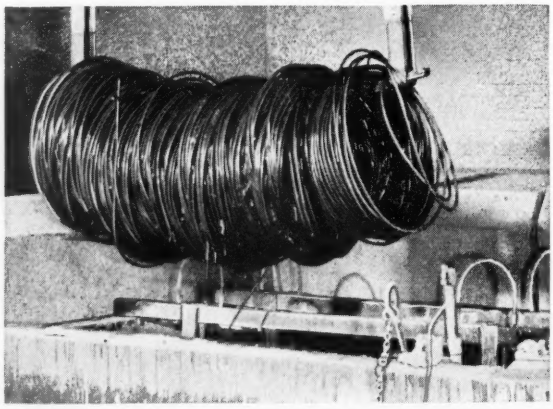
DU PONT SODIUM HYDRIDE DESCALING PROCESS

Descaling capacity up 300%—man-hours cut in half! That's the report from just one of the many steel mills that have replaced older descaling methods with the modern Du Pont Sodium Hydride Process.

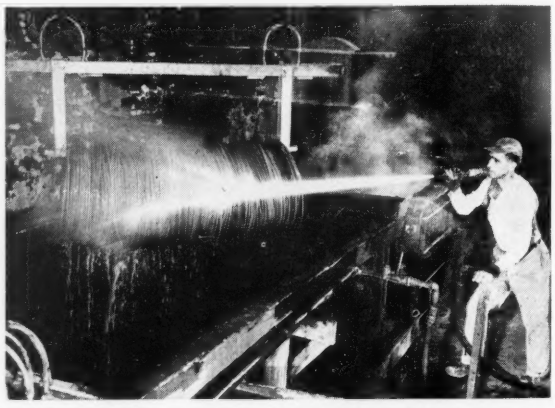
Important savings and advantages like these are possible because of the high-speed effectiveness of the process. Just *one* fast treatment (10 to 20 minutes) is all it takes to completely descale most metals. Retreatments are rarely needed. Costly, scale-breaking operations used with older descaling methods are eliminated entirely!

With the modern Du Pont descaling process there's never any danger of etching or pitting—never a costly reject due to loss of gauge. Base metal is always protected since bath action stops the instant scale has been reduced. And the process is so easy to operate that any pickler can be trained to run it—within hours!

If you are descaling metals which are unaffected by fused caustic at 700°F., it will be to your advantage to talk with us about the Du Pont Sodium Hydride Process. Du Pont pioneered this modern descaling method and can bring a depth of technical experience to bear on your descaling problems. There's no cost for this service which includes expert aid in the construction, installation and operation of the process. Just call our nearest district office or send in the coupon below.



A YOKE of carbon steel wire is lifted from the hydride tank. Reduced scale is then blasted off with a water quench.



AFTER a high-pressure water rinse, the descaled wire is ready for brightening. Complete cycle takes less than 20 minutes.

DISTRICT AND SALES OFFICES: Baltimore • Boston • Charlotte • Chicago Cincinnati • Cleveland • Detroit • Kansas City* • Los Angeles • New York Philadelphia • Pittsburgh • San Francisco. *Barada & Page, Inc.

DU PONT
Sodium hydride process for positive descaling

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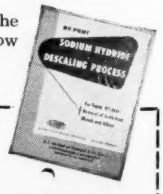
BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

Check coupon below for booklet describing the Du Pont Sodium Hydride Descaling Process—how it works—what it can do for you.



E. I. du Pont de Nemours & Co. (Inc.)
Electrochemicals Department WW-24
Wilmington 98, Delaware

☐ Please send me your booklet on Sodium Hydride Descaling.

☐ Please have one of your technical men call. I am interested in descaling _____.

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Firm _____

Address _____

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WIRE

(COLD ROLLED)

in Coils or Straight Lengths

COMPLETE METALLURGICAL SERVICE

Manufacturers of

SPRING WASHERS	RETAINING RINGS
ROUND EDGE FLAT WIRE	KEYSTONE SHAPED WIRE
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Shaped Wire in Coils or Straight Lengths, Ferrous or Non-Ferrous.

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THE NATIONAL LOCK WASHER COMPANY

PRECISION SHAPED WIRE DIVISION

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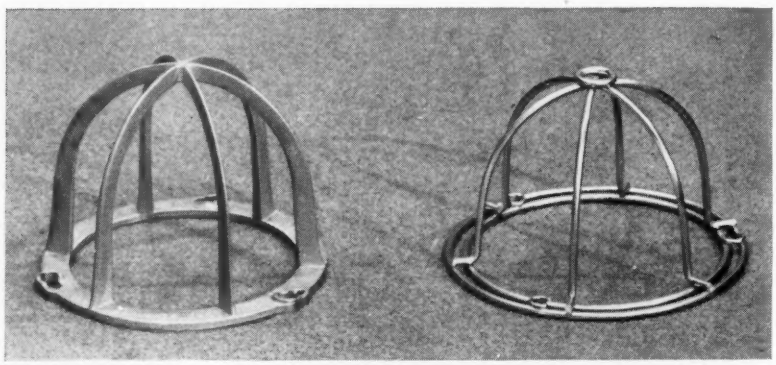
BETTER PRODUCT DESIGN WITH STEEL WIRE

LEGS FOR FOLDING TABLE – Attractively finished in black to resemble wrought iron, steel wire is welded to achieve a stronger, less costly construction than wooden legs. Steel wire is adaptable to a great variety of finishes.

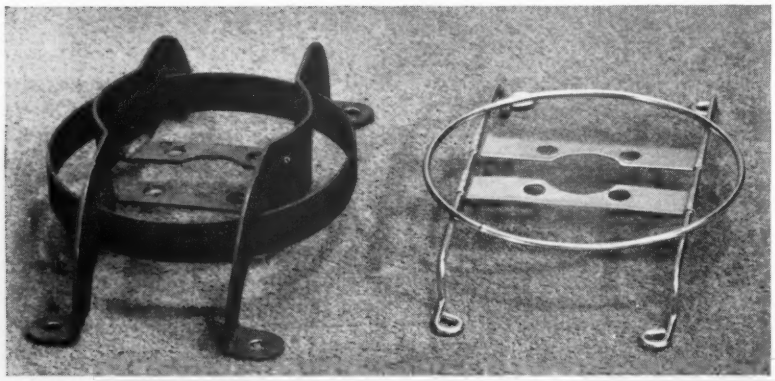
Steel wire can often solve a tricky problem in product design. Besides its eye appeal and great strength, steel wire often makes possible real savings, too. It's readily available and easy to fabricate.

In our modern wire mills we're turning out all kinds of steel wire – for cold-headed items, welded products, springs, gadgets, hardware, fasteners. Some are ordinary grades of wire; others are "specials."

Perhaps you have a design problem to which steel wire would furnish the solution. Let us help you select the grade that combines the strength, ductility and finish that the job requires. Phone or write the nearest Bethlehem sales office for complete information.



LIGHT GUARDS – The improved welded-wire design, at right, uses two concentric rings as a base, spaced to accommodate mounting bolts. Made from economical steel wire, the guard is stronger and less costly than the casting at left.



MOTOR MOUNT – Using spot-welded wire, the redesigned unit at right weighs only 12 per cent as much as the previous design at left. The use of steel wire greatly reduces the cost – and appearance is improved.

Photographs reproduced through the courtesy of E. H. Titchener & Co., Binghamton, N. Y., long a user of Bethlehem Wire. This firm specializes in the imaginative use of wire to simplify product designs and reduce production costs.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

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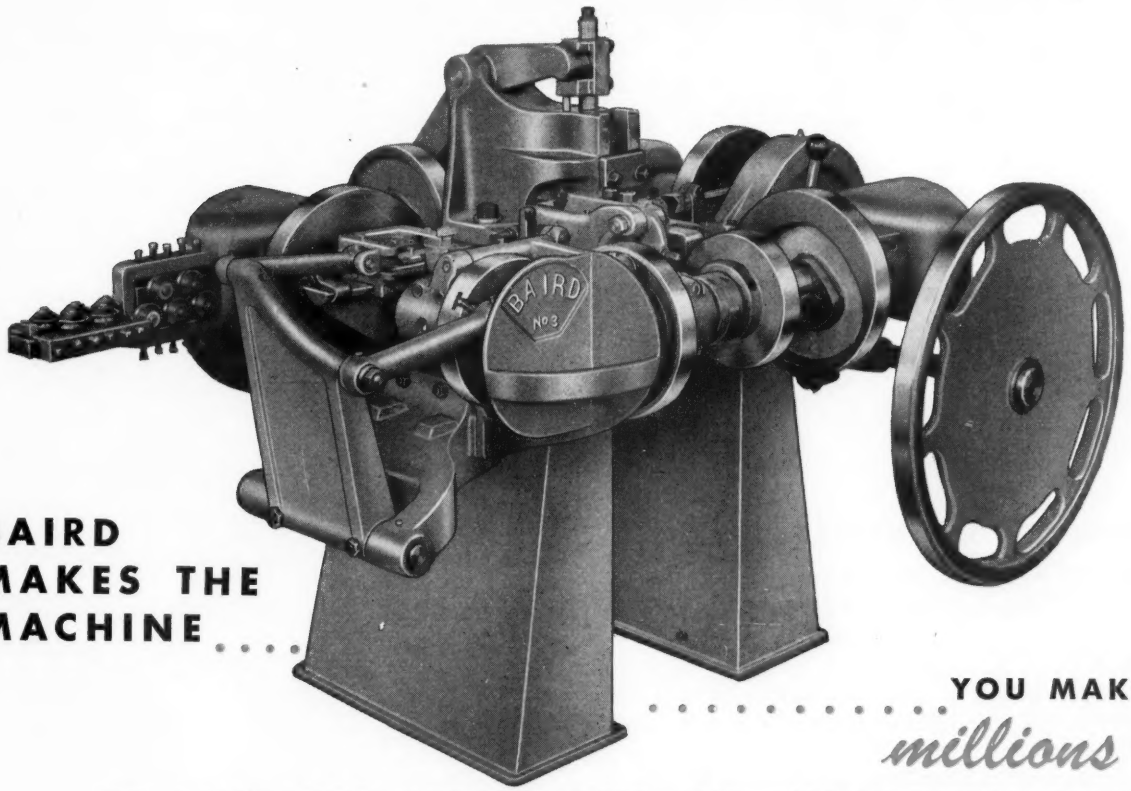
HIGH PRODUCTION TOOLING



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. . . OF ACCURATELY FORMED WIRE AND RIBBON METAL PARTS

The Baird automatic Four-Slide Machine produces an extremely wide variety of articles made of any commercial wire . . . round, half-round, square, or flat . . . at highest speeds. It takes coiled wire from a reel, straightens, feeds, and cuts off the required length . . . then forms and ejects the part produced. Eight sizes handle shorter wire lengths; three sizes take longer lengths to 32½".

By means of special attachments, the versatility of the machine is further extended to include the making of round wire and ribbon metal rings, secondary cut-offs, lettering, and other operations.

The detailed and complete story, with specifications, is told in our new Four-Slide Bulletin. If you require hundreds of thousands or millions of wire units to ½" dia., or flat ribbon metal products to 1½" wide . . . this is your profit-making machine. Send for bulletin.

3BA53

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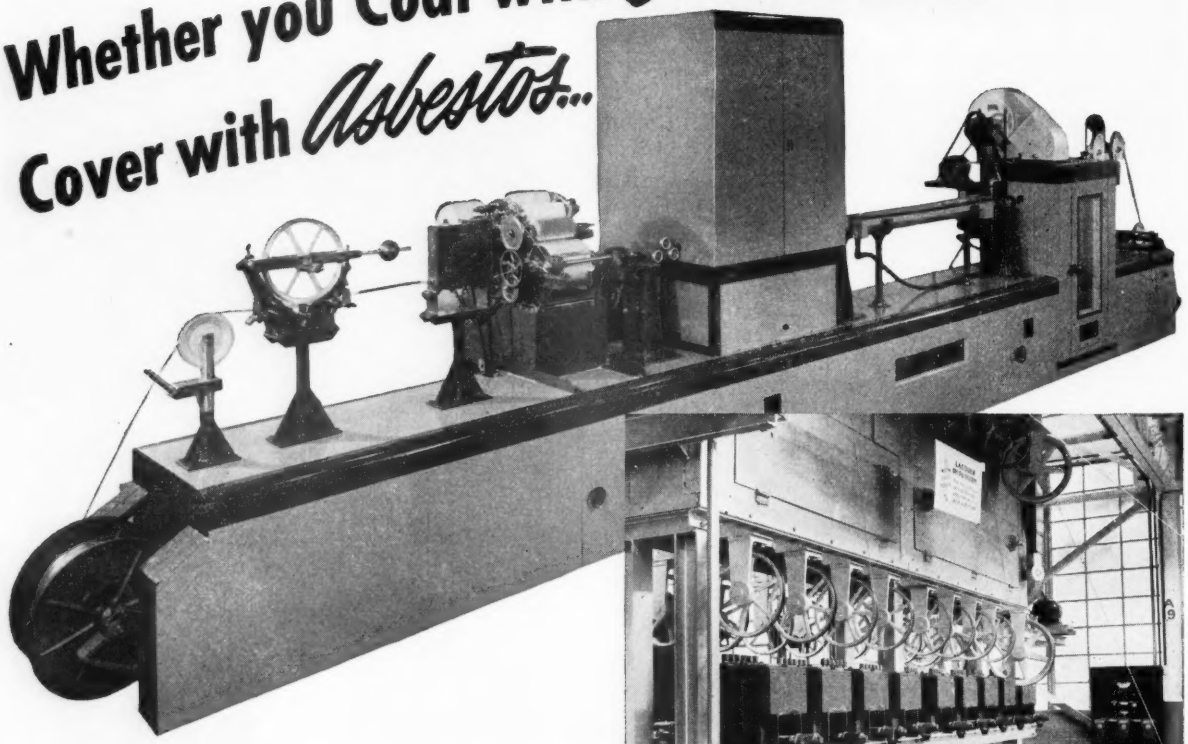
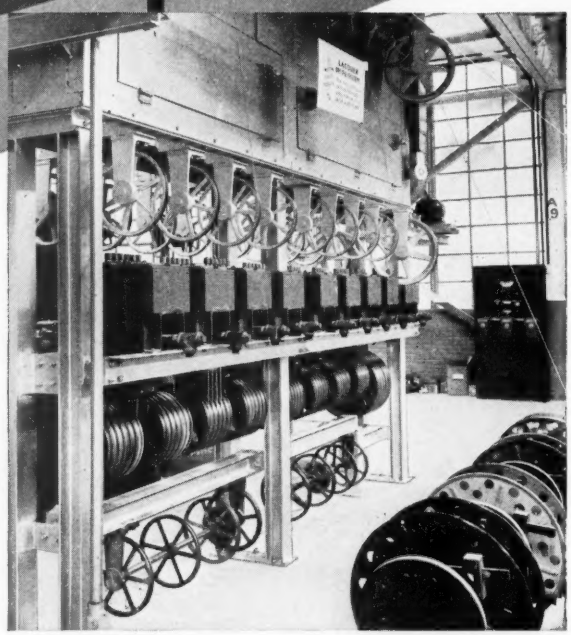
Whether you Coat with *Solutions* or Cover with *Asbestos*...





YOU'LL DO IT BETTER, FASTER, AT LOWER COST WITH AN IOI SYSTEM OF ADVANCED DESIGN

● Are you looking for ways and means of cutting production costs in your wire insulating operations? The largest wire mills in the world have found the answer to this problem by installing wire insulating systems and machines designed and built by IOI.

Whether your operations involve solution coating with lacquer, enamels, organosols or plastisols, or covering with asbestos, there's an IOI unit of advanced design that will increase your production, cut your labor requirements and decrease your production costs.

The lacquering unit and asbestos insulating machine pictured are typical of IOI's developments in advanced engineering on sound basic principles, efficient design and rugged construction.

Write for these helpful IOI booklets:

"Lacquering of Insulated Wire and Cable," "The Handling of Webs and Monofilaments."

ORGANOSOL COATER—The organosol system shown above will handle 9 ends of wire, each end being coated with as many as 8 individual coats. It is the thirty-second such system installed by IOI. Photograph shows the general arrangement of the coating pots, the wire travel, the bottom idler sheaves and the base of the evaporating tower.

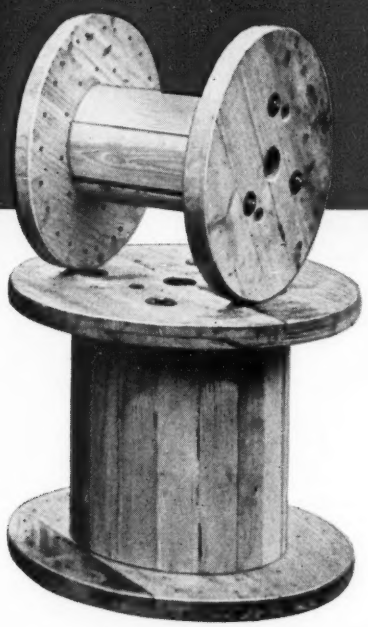
ASBESTOS INSULATING MACHINE—The IOI unit pictured at top left unwinds, wraps, cards, slicks, impregnates, cools, polishes, dries and winds—all in one continuous, fast operation. It handles a wide variety of wire sizes and asbestos wall thicknesses, utilizing hot or cold saturants. Easily accessible operating controls are located in base of machine. The unit is ruggedly constructed, easy to keep clean and maintain.

INDUSTRIAL IOI ENGINEERING VERSATILITY **OVENS, INC.**

13807 TRISKETT ROAD CLEVELAND 11, OHIO

WE have EXPANDED!

in order to offer YOU...



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on
WOOD REELS
for
CABLE • ROPE • WIRE

THIS IS WHAT WE HAVE DONE IN THE LAST YEAR TO GIVE YOU BETTER REELS AT LOWER COST:

- Considerably expanded the plant floor space.
- Equipped it completely with new machinery.
- Built new modern kilns for drying lumber.
- Added more trucks to the delivery fleet.
- Installed modern material handling equipment in buildings and yards.
- Paved over 6 acres of lumber yard space—which accommodates millions of board feet of lumber for reel manufacture only.

HIGH SPEED
SHIPPING SERVICE in our . . . OWN TRUCKS
within a radius of 200 miles from the plant. Fast freight will bring your Bridge reels in 5 days or less [illegible] of the Mississippi.

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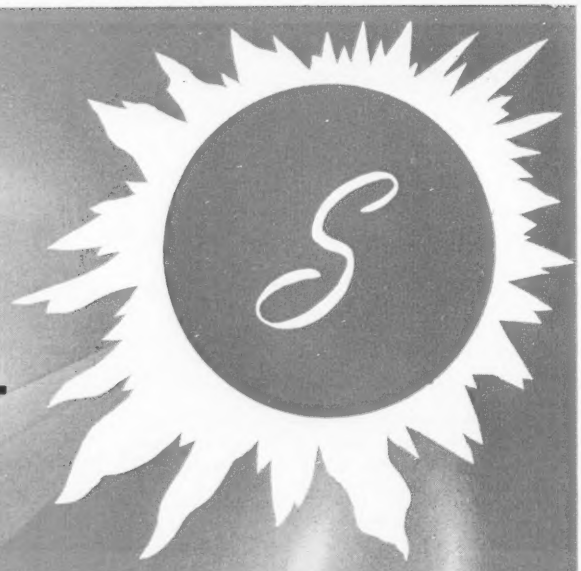
"REAL GOOD . . .
Let us quote on your reel needs. Send your specifications. Better yet, visit our plant and see how and why our reels are made so well at so low a cost.
WOOD REELS"

STAYS BRIGHT AS DAY ! WITH

STANDARD'S BRIGHT WIRE COMPOUNDS



STANDARD INDUSTRIAL COMPOUNDS COMPANY has pioneered most of the outstanding contributions to better wire drawing through better lubricants. Consult with **STANDARD** for the solution of your difficult problems. We welcome your inquiries.

STANDARD WIRE DRAW NO. 15

A new and different Compound for wet drawing, made from new and different materials that have a natural affinity for metals, a natural wetting-out characteristic, without the addition of a wetting agent.

Protects the wire from oxidizing for considerably longer periods than conventional compounds. Preserves the bright finish on copper coated or liquor finished wire and prevents tarnish on copper or brass wire for longer periods of time.

Below are some of the advantages of this compound:

A. Small amounts needed. Due to the natural affinity for metal small amounts of this compound are needed. Draws high carbon wire at high speeds with a fat content as low as .30 per cent, because of this affinity for metal and the natural wetting-out characteristics.

B. Low pH value.

C. Protects steel wire from rusting and copper coated and liquor finished steel wire from oxidizing. Protects copper and brass wire from tarnishing.

D. A clean compound. Keeps equipment clean and drawn wire has a clean finish.

Contact one of our representatives below or our home office for details on this new compound and a sufficient quantity for test will gladly be furnished.

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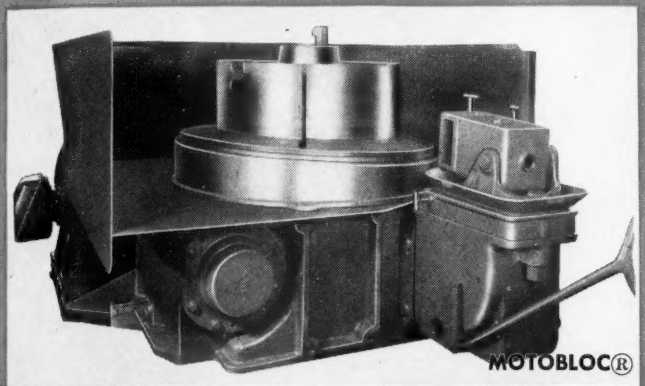

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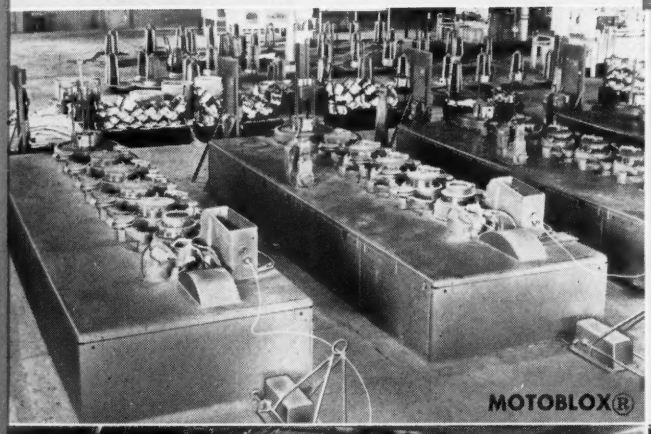
—you name your cold drawing requirement . . .

—let us name the profit making ***VAUGHN MACHINE*** *for your job!*

VAUGHN means *everything* in Cold Drawing Equipment—and a great deal in constructive consultation. We will be happy to translate your production requirements in terms of Vaughn machine productivity, at your convenience, and without obligation.



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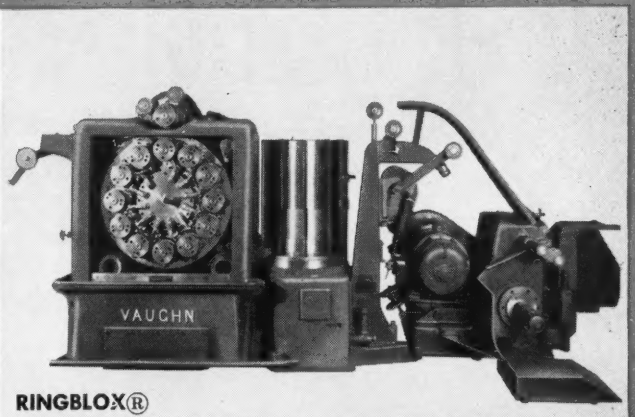

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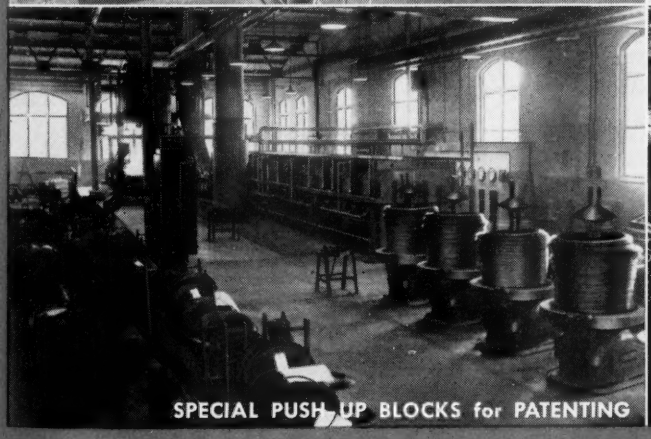
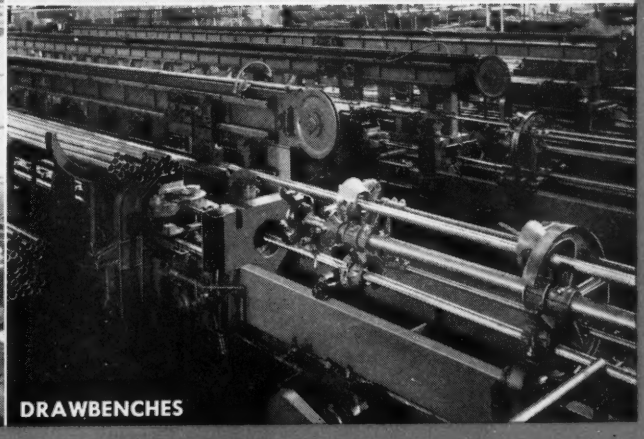


SPECIAL PUSH-UP BLOCKS for PATENTING



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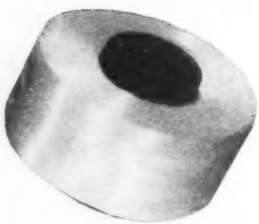
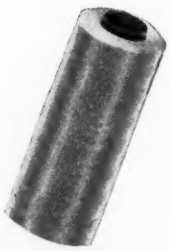
L·O·F Fiber·Glass Yarns

now made for all electrical insulations



A complete series of continuous filament yarns—including 75-, 150-, 225-, 450- and 900-series yarns—now are offered the wire and cable industry by Libbey·Owens·Ford.

L·O·F yarns are made in a wide variety of single- and multiple-end packages. They can be used directly on standard types of magnet wire serving and wire covering machines, as well as on braiders, knitters and other conventional textile equipment. Waxed yarns are available, as well as special after-treatments.



Why not consult us on your electrical insulation needs. Our expanded production facilities insure delivery of your quality L·O·F Fiber·Glass yarns on schedule. Contact your nearest L·O·F office (offices in 26 major cities). Or write: Libbey·Owens·Ford Glass Company, Fiber·Glass Division, 2624 Wayne Building, Toledo 3, Ohio.

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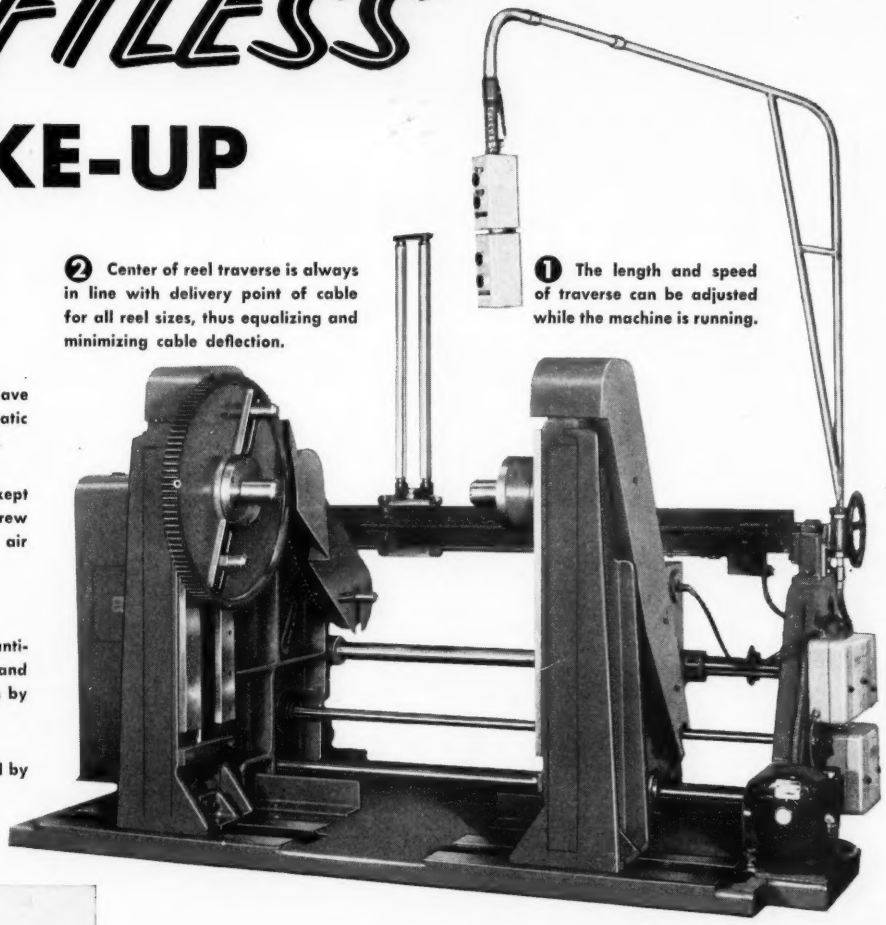
FIBER · GLASS

LIBBEY·OWENS·FORD GLASS COMPANY
FIBER·GLASS DIVISION

SHAFTLESS TAKE-UP



❶ The length and speed of traverse can be adjusted while the machine is running.

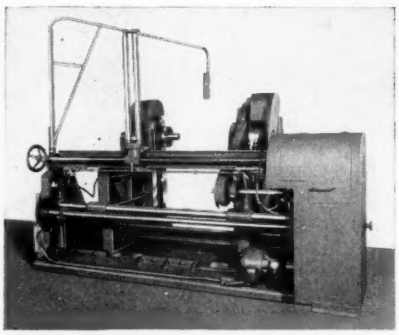
❷ Center of reel traverse is always in line with delivery point of cable for all reel sizes, thus equalizing and minimizing cable deflection.

❸ Reel gear and drive pinion have a special tooth form for automatic engagement when reel is raised.

❹ Light cable tensions are kept uniform by reversing traverse screw direction by means of solenoid air valve and compressed air.

❺ Both reel frames with anti-friction bearing pintles move in and out of engagement with the reels by means of a motor-driven screw.

❻ Reels are raised and lowered by motor-driven screws.



Available for reels of following sizes:

36" diam. to 52" max. diam.
36" diam. to 72" max. diam.
36" diam. to 84" max. diam.
42" diam. to 96" max. diam.

This heavy duty Take-Up is the newest addition to our line of wire reeling machinery. It handles bare or insulated cables of all weights at a wide range of speeds . . . and profitably. Swinging pendant push button station provides quick and convenient operator control. A multiple disc slip friction drive that can be adjusted while the Take-Up is running, or independent motor drives, can be supplied. This versatile machine speeds the production of high quality cables and can be adapted by our engineers to satisfy the special requirements of your plant. Write us for further information and details. New England Butt Company, 304 Pearl Street, Providence 7, R. I. James Day (Machinery) Ltd., 28 Maddox St., London W 1, England.

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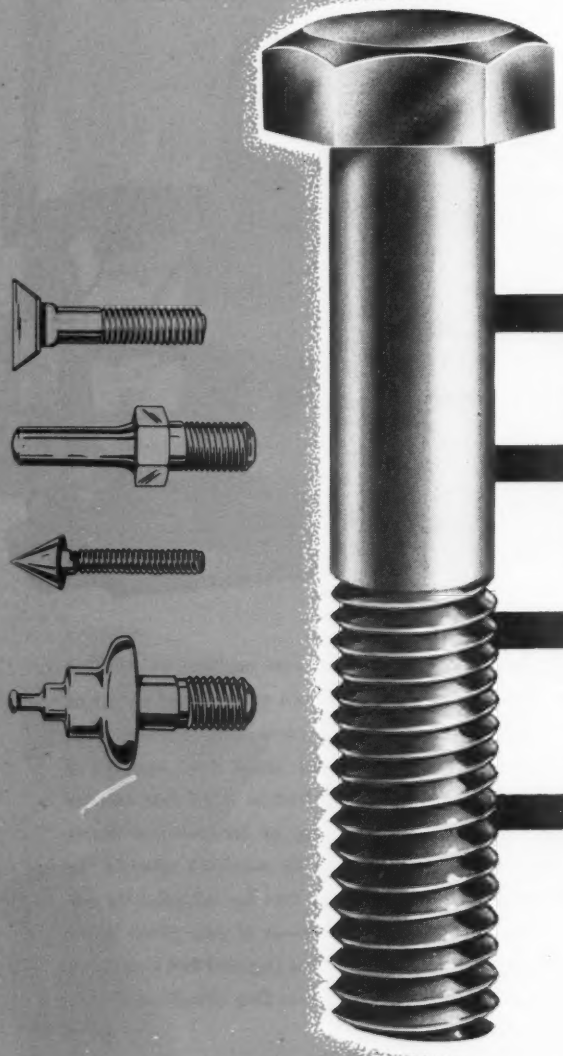

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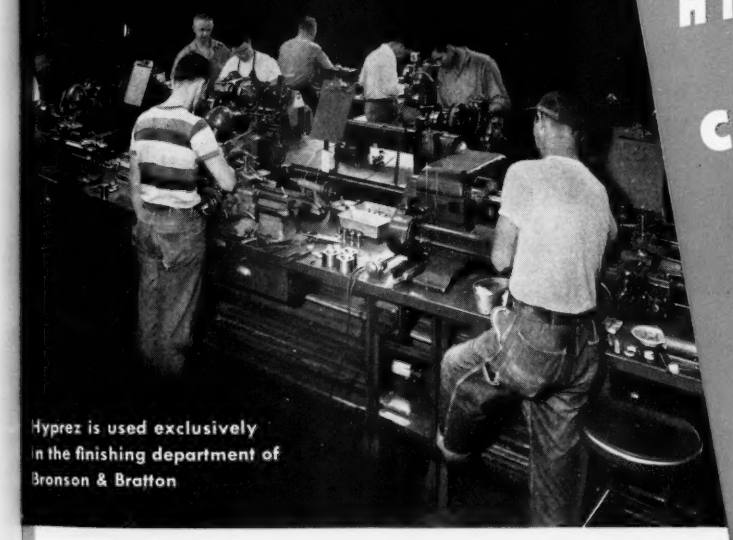

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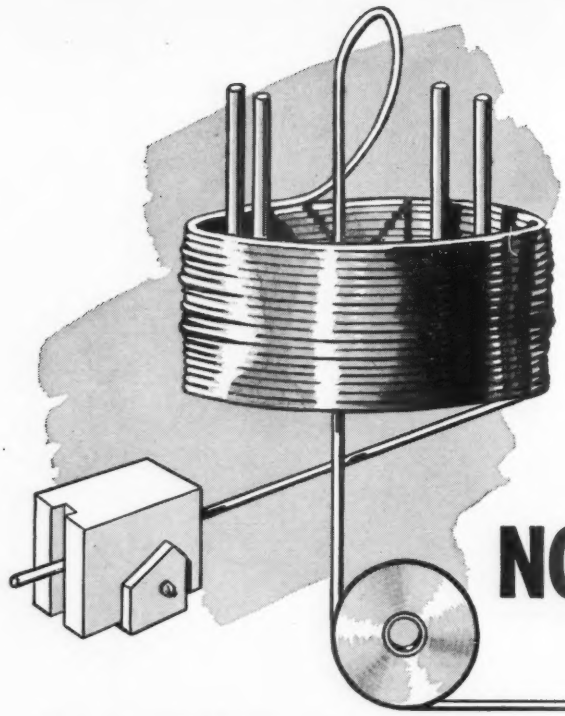

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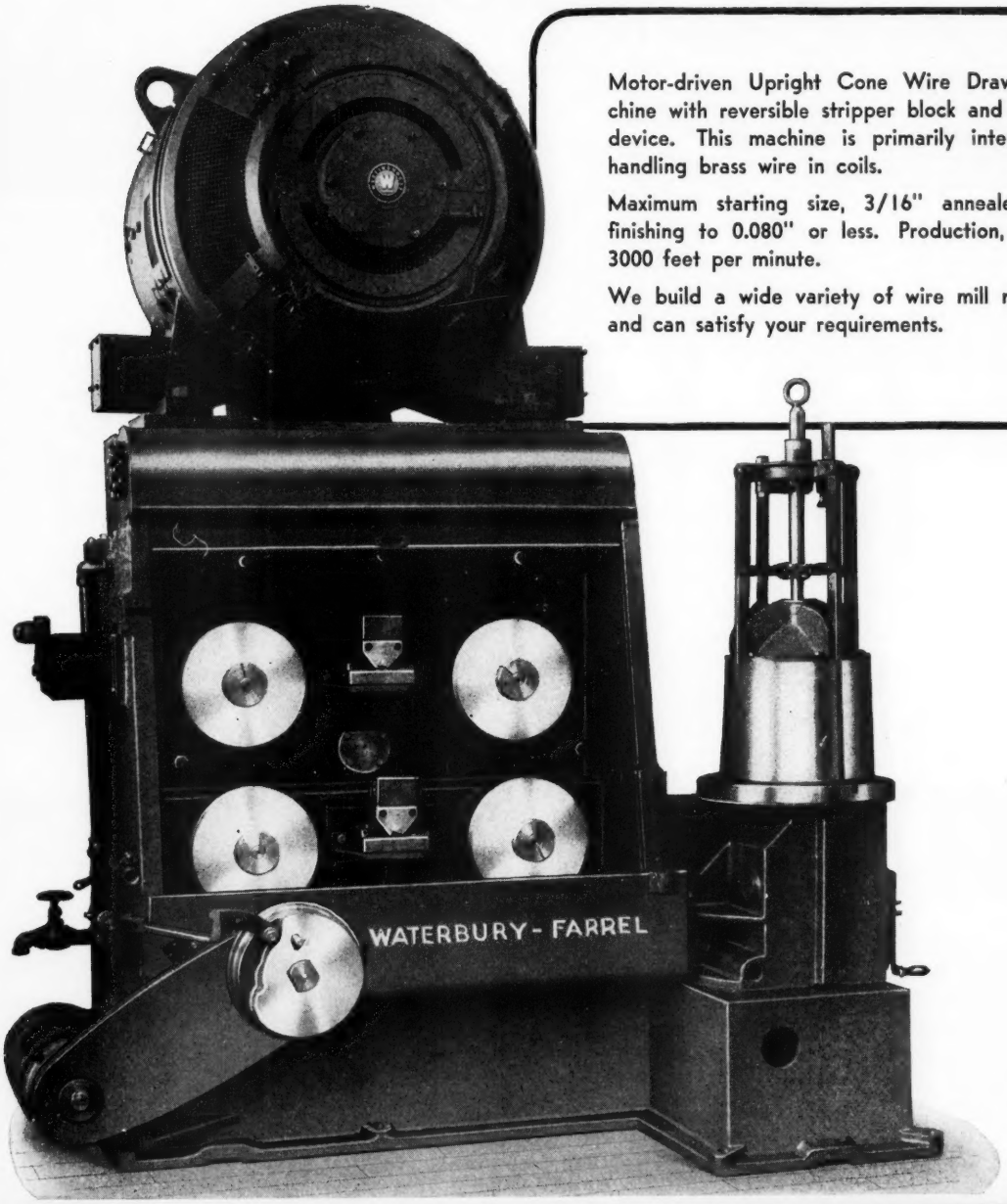

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The Wire Outlook

Now that we are well started along the pathway of another year, although the bears are still with us —mostly Fair Dealers who would like to see the present Administration embarrassed—most observers and industry leaders expect a good year. It should be good by any standards except those of 1953.

People spent freely during the holidays, banker attitudes are less cautious, most businesses have ample liquid assets, the government will be friendly to business and loans will be easier.

Steel making capacity increased over 6,750,000 tons in 1953 to 124,330,000 tons, which is 35% higher than in 1945 and 52% higher than in 1940. It is estimated that 100 million tons of steel will be needed for 1954. Something over 111 million tons was produced in 1953.

Business spending for plant, equipment and inventory is expected to spark good business this year, with the expectation that Government policies favorable to business will keep such investments at a high level. Accelerated stockpile buying is serving to bolster the prices of many metals, making it undesirable to hold up purchases in anticipation of lower prices.

Two U.S. Supreme Court decisions are of interest. One confirms the right of an employer to use company time and premises to assemble and address employees, without granting similar time and use of the premises to the union. However, employer speeches should not contain threats of reprisals or promises of benefits. The second is a decision upholding the right of an employer to discharge employees for "cause." In this case, non-striking employees distributed handbills attacking the employer's policies and products.

There has been a lot of publicity given to layoffs. When business is at boom peaks, workers are hired freely and the less efficient are weeded out when things slow down. It is stated that many of the layoffs are seasonal and most others the result pruning out the deadwood. Better unit production is expected this year.

The fastener field has been affected by inventory adjustments of jobbers and dealers, which have cut shipments from 8 to 10%. What has happened is that inventories are being cut so that the manufacturer is forced to carry the stocks, from which immediate deliveries are expected to be made.

Many premium prices on wire products are being pared, including those on high carbon spring grades. Because of the factor noted above, cold heading wire sales have been slow. This should adjust itself soon, however. Automotive demand has picked up and is expected to continue fair for all types of wire used by the industry through the first quarter.

Seasonal slack has made the demand for merchant wire sales slow, as farm purchases are being made only to fill pressing needs. The ability of wire mills to make prompt deliveries, has caused most customers to curtail forward orders, the result being that backlogs for most types of wire are practically nil. This is one of the adjustments brought about by a buyer's market to which our industry will have to accustom itself after so many years of having to pro-rate limited supplies among a lot of hungry customers.

Competition may be tough. It means harder and more intelligent selling, but competitive enterprise is better for the country. History has demonstrated that totalitarian planning results not only in the destruction of business, but usually of the state itself. Happily for us, we are in a period, painful though it may be, in which we are slowly extracting our Government from the mire of totalitarian trends and influences and again are able to see the blue sky of expanding opportunities for private enterprise.

—from the Editor's Desk

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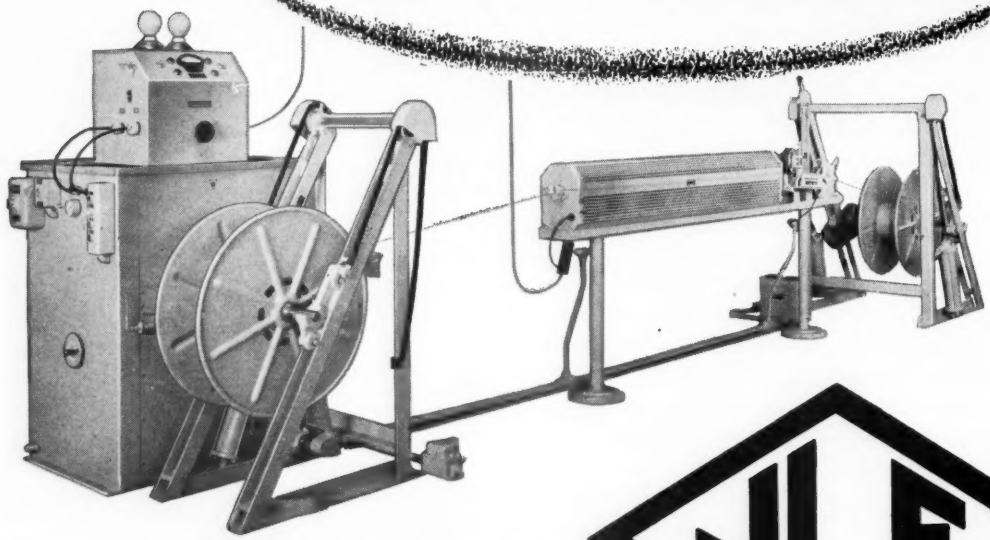

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Vol. 29 FEBRUARY, 1954 No. 2

Effect of Heat-Treatment on the Magnetic Properties of Cold Worked 18-8

by Samuel Storchheim
Engineer in Charge
Atomic Energy Division
Sylvania Electric Products Inc.
Bayside, L. I., New York

The author has prepared a sequel to his first article on the magnetic properties of stainless steel wire, in which he shows the effect of heat-treatment on cold-worked wires.

Cold-working of non-magnetic austenitic 18-8 stainless steel causes the austenite to be converted to magnetic martensite. An article published in the December, 1953, issue of Wire & Wire Products discussed the effect increasing percentages of cold reduction of area had on the permanent magnetic properties of 18-8 wires. The data presented here show the effects heat-treatment has upon the magnetic properties produced in cold-worked wires. In addition, some information regarding the effect temperature has on tensile and electrical properties is presented.

★ ★ ★

What was done to obtain the information contained herewith was to take wires of various commercial chemical analyses, cold-work them to a permanently magnetic condition and then strand-anneal them in cracked ammonia at various temperatures and for different lengths of time. The length of time for the wire to travel through the furnace hot zone, unless otherwise specified was two seconds. In all instances, the diameter of the wire heat-treated was 0.004".

★ ★ ★

After heat-treatment, six strands of wire representing each of the different reaction conditions used were tested for remanence (Br) and coercive force (Hc). This was done in a Hysteresis Loop Tester unit. In several cases, electrical resistivity and ultimate tensile strength data were also determined.

Results

Wire of Analysis 1 in Table I was given a 70% reduction in area. Following this it was then an-

TABLE I

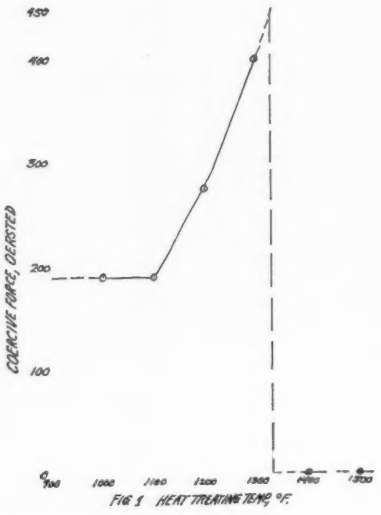
% Chemical Analyses of 18-8 Steels Used

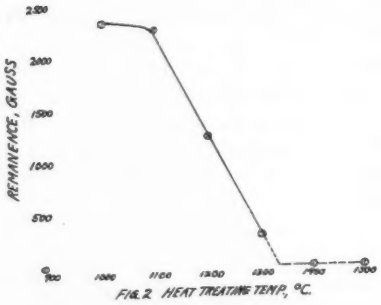
No.	Ni	Cr	Mn	Si	C	Mo, approx.	Fe
1	9.02	17.78	0.48	0.38	0.095	.09	Balance
2	8.75	18.08	0.54	0.38	0.08	<.10	Balance
3	8.70	17.79	0.52	0.38	0.09	.10	Balance
4	9.41	18.39	0.91	0.59	0.08	not found	Balance

nealed at a number of increasing temperatures. After annealing it was magnetically tested, the results obtained being listed in Table II and graphically shown in Figs.

TABLE II

Temperature °C	Temperature °F	Hc, oersted	Br, gauss
540	1000	190	2290
595	1100	190	2260
650	1200	270	1240
705	1300	400	300
760	1400	non-magnetic	
820	1500	non-magnetic	





1 and 2. It was observed that there was a lack of response at low heat-treating temperatures, i.e., very little change in Hc and Br was observed after heating at temperatures of 1100°F or lower.

★ ★ ★

In order to determine if the lack of magnetic change at low temperatures was real, wires were held at 315°C (600°F) for two hours. No observable change in Hc-Br was found when testing these wires.

The data obtained indicated temperatures up to about 595°C (1100°F) had little if any effect upon the magnetic properties of the wire. Heating wires at approximately 595°C (1100°F) had a very marked effect upon Br and Hc; the Br dropped and the Hc rose with increased annealing temperature until the wires eventually became paramagnetic, i.e., all signs of ferro-magnetism had disappeared. The change in magnetic values was associated with the transformation of the ferromagnetic martensitic phase to the paramagnetic austenitic phase. The total transformation of martensite at 760°C (1400°F) to austenite caused the wire to become fully nonferromagnetic.

★ ★ ★

The interesting very rapid and great changes in Br-Hc values between 650°C (1200°F) and 705°C (1300°F) were the object of a more detailed investigation. This time wire of analysis 2 and reduced 98% was used to give a more indicative evidence of the change, since wire reduced by 98% and of low nickel content has more martensite to convert than wire of about the same nickel content, but of 70% reduction. The tests carried out for both two and four seconds time through the hot zone, repeatedly showed the same results; as the annealing temperature was raised, the Hc rose and the Br lessened until the wire eventually became fully paramagnetic, see the data in Table III.

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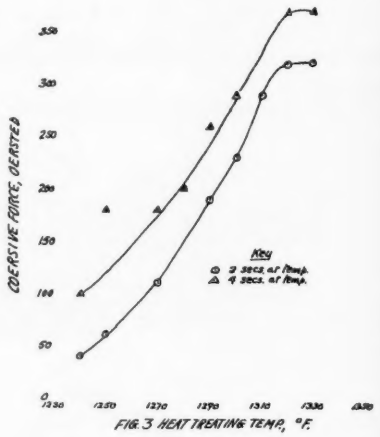
Br-Hc values were graphically related to the temperature of annealing. It may be seen, Figs. 3 and 4, that in all cases fairly



smooth, curved lines were obtained. Observe that the plots for coercive force are displaced from each other a fairly constant distance, that is, they do not approach or cross each other as the annealing temperature rises. Fig. 4 shows the wires become less and less ferromagnetic as the temperature is increased. Extrapolation indicates the wires would become paramag-

TABLE III

Temp. °F	2 Seconds at Temperature Hc, oersted	2 Seconds at Temperature Br, gauss	4 Seconds at Temperature Hc, oersted	4 Seconds at Temperature Br, gauss
1240	40	-	100	9000
1250	60	11,400	180	4600
1270	110	7,500	180	4000
1280	280	7,500	200	2800
1290	190	3,000	260	1700
1300	230	1,800	290	1300
1310	290	1,280	320	660
1320	320	410	370	400
1330	320	400	370	260

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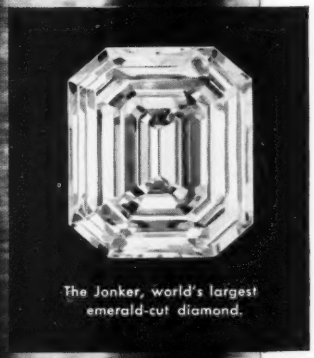

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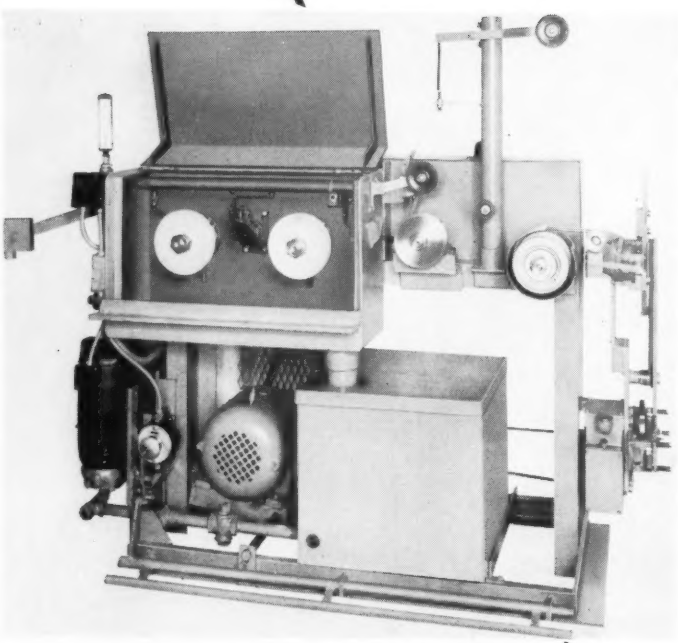

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netic if a temperature greater than 1350°F were used. (This also points out that the coercive force would decrease to zero from the relatively high values exhibited in Fig. 3). In addition, it is noted that both remanence curves approach each other as the heat-treating temperature increases. The rate of decrease in Br is not as great for the wire in the furnace for four seconds than the wire in the furnace for two seconds.

It was observed, for wires reduced in area 98%, i.e., of high Br and low Hc values, that at about 630°C (1150°F) a very sudden and sharp increase in Br was obtained with practically no observable change in Hc. This was observed to take place just prior to the large changes in Hc. As representative data the following are quoted:

98% REDUCTION

Before Heat Treating			Heat Treating at about 630°C (1150°F)		
No.	Hc	Br.	No.	Hc	Br.
1	80	7500	1	90	8950
2	30	5500	2	30	10000
3	55	7250	3	45	10300

This observation can possibly be a sudden precipitation of carbon from the martensitic phase. The carbon precipitates out probably as a chrome carbide. This would deplete the magnetic phase of chrome and leave behind domains of iron-nickel alloys with a considerably greater ferromagnetism. Thus, greater values of remanence could

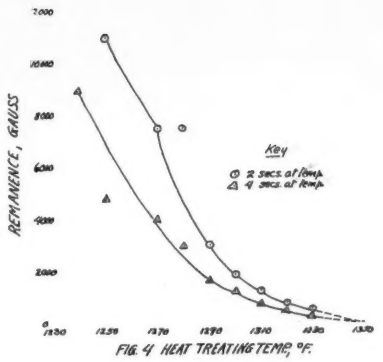

FIG. 4 HEAT TREATING TEMP, °F.

be accounted for. As the temperature is increased, the martensite starts to convert to austenite which in turn starts taking the precipitated carbide back into solution.

Mechanical Properties

Ultimate tensile strength data for wires of analyses 3 and 4 showed a gradual, almost linear, decrease with the increase in temperature of annealing as shown in Fig. 5, see Table IV for the data. This can be accounted for by the formation of the low tensile strength austenite in the matrix of relatively high tensile strength martensite, and to the relief of stresses contained in strained areas adjacent to and within the martensitic zones. The greater the amount of austenite introduced, the lower the tensile strength until only austenite is present with its rather low tensile strength when compared to martensite.

TABLE IV

Ultimate Tensile Strength as a Function of Temperature

Temp., °F	Ultimate Tensile Strength, psi	
	Analysis No. 3	Analysis No. 4
1200	397,000	400,000
1220	370,000	382,000
1240	328,000	350,000
1260	306,000	-
1280	283,000	313,000
1290	-	306,000
1300	252,000	-

★ ★ ★

A rather interesting observation was made regarding stress relief. Most alloy wires after they are drawn through dies invariably acquire a curl. The diameter of the curl can, to a considerable degree, be varied by manipulation of the dies; however, the wire drawer can almost never completely eliminate it. When stainless wire comes out of the heat treating furnace at the temperature where magnetic changes occur, it usually has a lesser curl diameter. This can perhaps be accounted for, to an extent, by the change in volume caused when the greater volumed martensite transforms to the lesser volumed austenite. If the change is sufficiently great, the wire comes out perfectly straight;

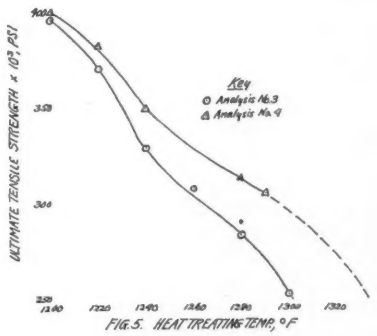

FIG. 5. HEAT TREATING TEMP, °F.

if not, the wire comes out with a curl but much larger in diameter than the original curl of the wire in the non-heat-treated condition.

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It was found that the curl diameter of the wire could be increased but not eliminated without changing the Br-Hc values by sending the wire through the furnace at a lower temperature, 540°C (1000°F). This suggested that the above change in curl diameter also was dependent upon stress relief.

Electrical Properties

It was found that the electrical resistance decreased with increasing annealing in the range where magnetic changes occurred. To substantiate this, data obtained for wire reduced by 98% is as follows:

Temperature	Resistivity in Ohm-CM/ft.
Room temperature	650
660°C (1220°F)	585
690°C (1280°F)	490

This can be explained by the fact that the highly stressed martensite is more resistant to the conduction of an electric current than is the stress relieved mixture of martensite and austenite. Minimum resistivity would be had when austenite alone is present in the matrix.

Effects of Time At the Annealing Temperature

The effect of annealing time was obtained by measuring the Br-Hc values of cold-worked wires representing analysis No. 2 of Table I. Wires of this analysis were held at three temperatures, 650°C (1200°F), 670°C (1240°F), and 690°C (1280°F) for varying lengths of time. The data obtained, see Table V, were plotted on Figs. 6 and 7 and clearly show the changes that had taken place. With increased time, Hc rose and Br declined in smooth curve-linear fashion at the heat treating temperatures used. The effect of temperature is quantitative, i.e., the higher the temperature the greater is the magnetic change. This can be explained by the fact that the longer the wire was at the temperature, the greater was the opportunity for the martensite to transform into austenite; the less martensite in the matrix, the lower the Br and the higher the Hc.

TABLE V

Effect of Time at Temperature on Coercive Force and Remanence

Time at Temp., Sec.	Held at 1200°F		Held at 1240°F		Held at 1280°F	
	Hc, oersted	Br, gauss	Hc, oersted	Br, gauss	Hc, oersted	Br, gauss
2	35	11000	45	11000	150	5800
4	30	10800	150	7000	170	2800
8	40	10200	210	3000	280	2200
16	150	8000	290	2000	300	1800
32	190	5000	320	1500	380	950

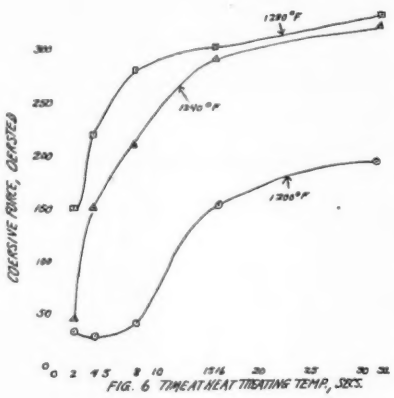

FIG. 6 TIME AT HEAT TREATING TEMP., SECS.

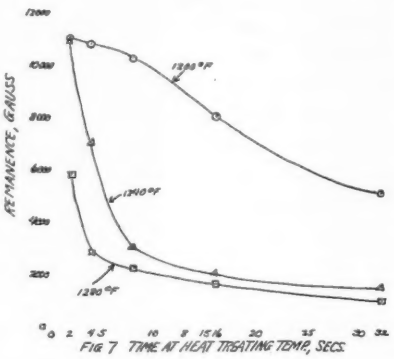

FIG. 7 TIME AT HEAT TREATING TEMP, SECS.

Summation of Results

The effects of heat-treating cold-worked 18-8 stainless steel wire may be summarized as follows:

1. An increase of temperature from room temperature to approximately 595°C (1100°F) did not cause any appreciable change in Hc-Br. At about 540°C (1000°F), stress relief of the worked wire evidences itself by "opening" of the diameter of the wires.

2. A sudden and large increase in Br with relatively no change in Hc was observed for very severely cold-worked wire, when annealed at approximately 630°C (1150°F).

3. At temperatures above 630°C (1150°F) the Hc-Br values changed continuously until a non-magnetic condition was reached. During this change, the Hc rose and the Br dropped. Curl diameter usually opened up completely above 630°C (1150°F).

4. Tensile strength went down as the annealing temperature was increased.

5. Electrical resistivity decreased as the temperature of annealing was increased.

6. The longer the time the wire was at a temperature of martensitic to austenitic transformation, the lower was the Br and the higher the Hc developed.

Acknowledgment

The author should like to thank the Wilbur B. Driver Co. for its permission to publish the data in this article.

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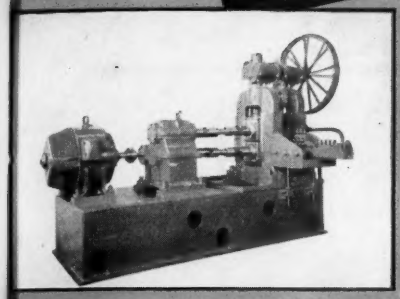
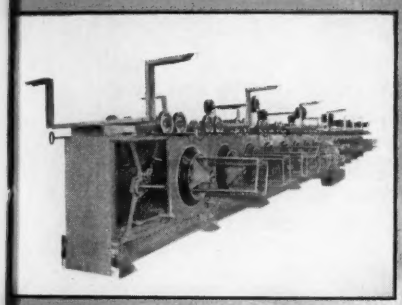
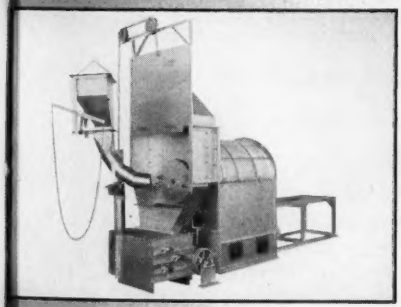


2—Hi Wire Flattening Mill



Wire Galvanizing Take-Up Frame



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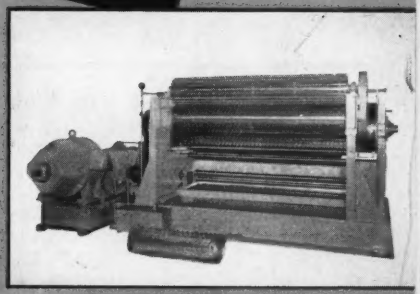

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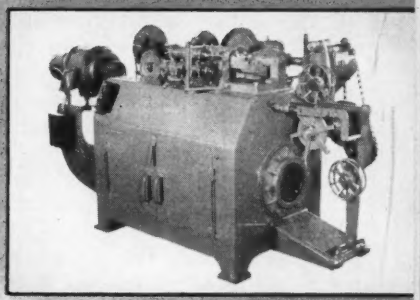

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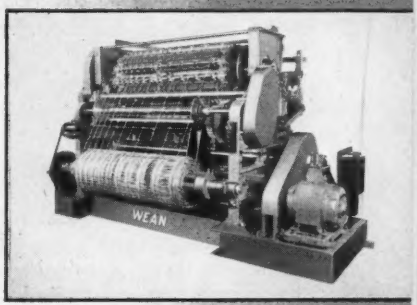

Hinge — Joint Fence Machine

Wean Equipment Corporation
CLEVELAND, OHIO

Discussion on Precision Spring Design

by M. Gerard Fangemann
General Manager
John Chatillon and Sons
New York, New York

PART 1

Logically, the first discussion of this series is on Precision Spring Design. In order to obtain fully the benefits of the discussions that follow, which have to do with Allowable Spring Stresses, Problems in Manufacturing Springs, and Inspection and Quality Control, knowledge of basic spring design is imperative. We will endeavor to present the basic spring design equations for the five main types of springs. These include extension springs, compression springs, and spiral, torsion, and form springs. At the same time we will discuss important characteristics of these springs, information on which is not usually published to any great extent. These characteristics include load deviation from straight line, hysteresis error and drift error. Illustrative problems have been prepared showing the use of the equations discussed and will be presented to each of you, along with other informative data, at the completion of this discussion.

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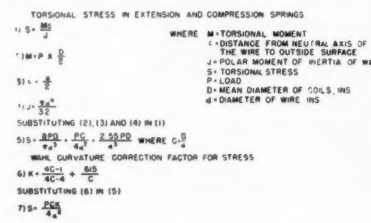
Our discussion will deal with precision springs. A precision spring in the true sense is one that is accurately calibrated for rate, that is accurately manufactured to close tolerances on physical dimensions, such as Outside Diameter and Hook Length, and one which has the least possible hysteresis and drift errors. For the ultimate in precision springs another characteristic is required, namely, that the spring be unaffected by temperature changes.

This dissertation on spring design was delivered by the author at a meeting of American Society of Mechanical Engineers in New York on October 6th. It contains the results of much research work and treats of many design aspects on which material has not previously been published. Due to its length it will be published in three parts, of which this is Part 1.

First I would like to discuss the design of extension and compression springs, since both types of springs use the same basic formulas in their design.

★ ★ ★

An extension spring is a helical-wound spring that offers resistance to a pulling force. These springs are usually made of round, square, or rectangular section wire. As the load is applied, deflection takes place principally due to the twisting of the wire. This twisting induces a torsional stress. The expression for torsional stress for round bars is the well-known


TORSIONAL STRESS IN EXTENSION AND COMPRESSION SPRINGS

1) $S = \frac{Mc}{J}$ WHERE M = TORSIONAL MOMENT
c = DISTANCE FROM NEUTRAL AXIS OF THE WIRE TO OUTSIDE SURFACE
J = POLAR MOMENT OF INERTIA OF WIRE
S = TORSIONAL STRESS
P = LOAD
D = MEAN DIAMETER OF COILS, INS
d = DIAMETER OF WIRE INS

2) $M = P \times \frac{D}{2}$

3) $c = \frac{d}{2}$

4) $J = \frac{\pi d^4}{32}$

SUBSTITUTING (2), (3) AND (4) IN (1)

5) $S = \frac{8PD}{\pi d^3} = \frac{PC}{.4d^2} = \frac{2.55PD}{d^3}$ WHERE $C = \frac{D}{d}$

WAHL CURVATURE CORRECTION FACTOR FOR STRESS

6) $K = \frac{4C-1}{4C-4} + \frac{.615}{C}$

SUBSTITUTING (6) IN (5)

7) $S = \frac{PCK}{.4d^2}$

DERIVATION OF STRESS FORMULA - EXTENSION AND COMPRESSION SPRINGS

Expression for torsional stress for round bars is well known equation:

$S = \frac{Mc}{J}$ --- Where: M = Torsional moment

c = Distance from neutral axis in center of section to outer surface

J = Polar moment in inertia

for round wire, maximum stress occurs at outer surface

$c = \frac{d}{2}$

$J = \frac{\pi d^4}{32}$

$M = P \times \frac{D}{2}$ for coil spring

Substituting, we get

$$S = \frac{Mc}{J} = \frac{P \times \frac{D}{2} \times \frac{d}{2}}{\frac{\pi d^4}{32}} = \frac{8PD}{\pi d^3} K$$ Where K = Wahl curvature correction factor

This can be written as:

$$S = \frac{8PDK}{\pi d^3} = \frac{PCK}{.4d^2} = \frac{2.55PD}{d^3} \text{ psi}$$ Where C = Spring index $= \frac{D}{d}$

equation $S=\frac{Mc}{J}$, where M equals the torsional moment and c equals the distance from the neutral axis in the center of the section to the outer surface. For round wire the maximum stress would occur at the outer surface, and c would therefore be equal to one-half the diameter, d, of the wire. J equals the polar moment of inertia, which is $\frac{\pi d^4}{32}$ for round wire. Now, the torsional moment, M, for a coil spring, is equal to P, the load, times $\frac{D}{2}$, where D equals the mean diameter of the spring. Combining these substitutions in the original stress formula, $S=\frac{Mc}{J}$, we arrive at an equation for calculating the maximum stress for extension springs, $S=\frac{8\,PD}{\pi d^3}$. In this equation, S equals the torsional stress in pounds per square inch; P is the applied load, in pounds; D is the mean diameter of the spring in inches, and is equal to the Outside Diameter minus one wire diameter, d. This equation is published in many forms by different spring makers, and handbook publishers. For example, this same equation could be written as: $S=\frac{PC}{.4d^2}$, and also as: $S=\frac{2.55\,PD}{d^3}$. In the first of these expressions C is the ratio $\frac{D}{d}$, which is called the spring index. All of these equations are essentially the same, and upon proper substitution will give identical answers. It should be noted that the stress obtained is for pure torsion only, i.e., no provision is made for the additional stress caused by curvature of the wire. A factor, by which the stress in the wire is increased because of the curvature of the coil, has been derived by Dr. A. M. Wahl, and published in "Mechanical Engineering" in 1929. This factor is as follows:

$$K = \text{Wahl Factor} = \frac{4C-1}{4C-4} + \frac{.615}{C}$$

It is seen that this factor is constant for each spring index C. Stress calculated by means of the aforementioned equation must be multiplied by this Wahl factor to obtain the actual value.

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Here is shown a handy chart for values of the Wahl Factor which you are going to receive later. For each value of the spring index C, the corresponding values of K, CK, and C^3 are given. You will recall that in the derivation of the stress formula $S=\frac{8PD}{\pi d^3}$, I started with the expression $S=\frac{MC}{I}$, which is for torsional stress in a straight bar (a bar having zero curvature). For zero curvature, the radius of curvature $\frac{D}{2}$ and the index $\frac{D}{d}$ would be infinite so that the value of the Wahl factor would become 1:

$$K=\frac{4C-1}{4C-4}+\frac{.615}{C}$$

$$=1+\frac{3}{4C-4}+\frac{.615}{C}$$

STRESS CORRECTION COEFFICIENTS

(WAHL FACTOR)

C = Spring Index = Mean Diameter / Wire Diameter
K = Curvature Correction Factor

C	K	CK	C^3	C	K	CK	C^3	C	K	CK	C^3
3.0	**1.58**	**4.74**	**27**	**6.5**	**1.23**	**8.00**	**274.63**	**10.0**	**1.14**	**11.45**	**1000**
.1	1.56	4.82	29.79	.6	1.23	8.10	287.50	.1	1.14	11.55	1030.3
.2	1.53	4.91	32.77	.7	1.22	8.20	300.76	.2	1.14	11.65	1061.2
.3	1.51	4.99	35.94	.8	1.22	8.29	314.43	.3	1.14	11.75	1092.7
.4	1.49	5.08	39.30	.9	1.22	8.33	328.51	.4	1.14	11.84	1124.9
.5	**1.48**	**5.16**	**42.88**	**7.0**	**1.21**	**8.49**	**343**	**.5**	**1.14**	**11.94**	**1157.6**
.6	1.46	5.25	46.66	.1	1.21	8.59	357.91	.6	1.14	12.04	1191.0
.7	1.44	5.34	50.65	.2	1.21	8.69	373.25	.7	1.13	12.14	1225.0
.8	1.43	5.43	54.87	.3	1.20	8.78	389.02	.8	1.13	12.24	1259.7
.9	1.42	5.52	59.32	.4	1.20	8.88	405.22	.9	1.13	12.34	1295.0
4.0	**1.40**	**5.62**	**64**	**.5**	**1.20**	**8.98**	**421.88**	**11.0**	**1.13**	**12.44**	**1331**
.1	1.39	5.71	68.92	.6	1.19	9.08	438.98	.1	1.13	12.54	1367.6
.2	1.38	5.80	74.09	.7	1.19	9.18	456.53	.2	1.13	12.64	1404.9
.3	1.37	5.89	79.51	.8	1.19	9.27	474.55	.3	1.13	12.74	1442.9
.4	1.36	5.99	85.18	.9	1.19	9.37	493.04	.4	1.13	12.84	1481.5
.5	**1.35**	**6.08**	**91.13**	**8.0**	**1.18**	**9.47**	**512**	**.5**	**1.12**	**12.94**	**1520.9**
.6	1.34	6.17	97.34	.1	1.18	9.57	531.44	.6	1.12	13.04	1560.9
.7	1.33	6.27	103.82	.2	1.18	9.67	551.37	.7	1.12	13.14	1601.6
.8	1.33	6.36	110.59	.3	1.18	9.77	571.79	.8	1.12	13.23	1643.0
.9	1.32	6.46	117.65	.4	1.17	9.86	592.70	.9	1.12	13.33	1685.2
5.0	**1.31**	**6.55**	**125**	**.5**	**1.17**	**9.96**	**614.13**	**12.0**	**1.12**	**13.43**	**1728**
.1	1.30	6.65	132.65	.6	1.17	10.06	636.06	.1	1.12	13.53	1771.6
.2	1.30	6.74	140.61	.7	1.17	10.16	658.50	.2	1.12	13.63	1815.8
.3	1.29	6.84	148.88	.8	1.17	10.26	681.47	.3	1.12	13.73	1860.9
.4	1.28	6.94	157.46	.9	1.16	10.36	704.97	.4	1.12	13.83	1906.6
.5	**1.28**	**7.03**	**166.38**	**9.0**	**1.16**	**10.46**	**729**	**.5**	**1.11**	**13.93**	**1953.1**
.6	1.27	7.13	175.62	.1	1.16	10.56	753.57	.6	1.11	14.03	2000.4
.7	1.27	7.23	185.19	.2	1.16	10.66	778.69	.7	1.11	14.13	2048.4
.8	1.26	7.32	195.11	.3	1.16	10.75	804.36	.8	1.11	14.23	2097.2
.9	1.26	7.42	205.38	.4	1.15	10.85	830.58	.9	1.11	14.33	2146.7
6.0	**1.25**	**7.52**	**216**	**.5**	**1.15**	**10.95**	**857.38**	**13.0**	**1.11**	**14.43**	**2197**
.1	1.25	7.61	226.98	.6	1.15	11.05	884.74	.1	1.11	14.53	2248.1
.2	1.24	7.71	238.33	.7	1.15	11.15	912.67	.2	1.11	14.63	2300.0
.3	1.24	7.81	250.05	.8	1.15	11.25	941.19	.3	1.11	14.73	2352.6
.4	1.23	7.90	262.14	.9	1.15	11.35	970.30	.4	1.11	14.83	2406.1

By comparing the value of K for a particular value of C with 1, you can immediately see how much the torsional stress is increased due to the presence of the coil curvature. You will note that for low values of C, the values of K are relatively high compared to 1.

★ ★ ★

For example, a spring having an index of 5 would have a Wahl factor of 1.31. If a spring were de-

signed for a stress of 60,000 psi using the stress equation without a correction factor, the actual stress would be 78,600 psi, an increase of 31%. It will therefore be found that in springs that are designed for very high stresses with spring indexes between 3 and 10, the Wahl factor plays a very important part in guaranteeing good spring design. In this range, the increase in stress due to curvature is 15% or more, depending on the index.

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This chart is also very useful if the alternate form of the stress equation $S = \frac{PC}{.4d^2}$ is used. When the Wahl Factor is included, this becomes $S = \frac{PCK}{.4d^2}$. In this case the value of CK can be immediately obtained for any value of the index C, quite a timesaver. Finally, the value of C^3 is tabulated. This value is required in the formula for the active number of coils in a spring which I am going to take up now.

★ ★ ★

Regarding calculation of active coils, we have worked out the derivation of this equation, but we will not present it at this time because the discussion would be too

NUMBER OF ACTIVE COILS = $\frac{FGd}{8PC^3}$ WHERE F = DEFLECTION IN INCHES, G = MODULUS OF RIGIDITY

RATE = $\frac{P}{F}$ FOR OPEN WOUND SPRINGS

RATE = $\frac{P_2-P_1}{HL_2-HL_1}$ FOR CLOSE WOUND SPRINGS (ALSO OPEN WOUND SPRINGS)

} = $\frac{Gd}{8NC^3}$

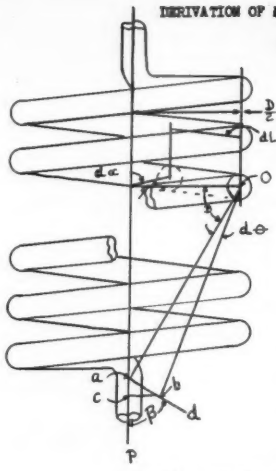
WHERE P_1 & P_2 ARE TWO DIFFERENT APPLIED LOADS

HL_1 & HL_2 ARE CORRESPONDING LOADED LENGTHS FOR LOADS P_1 & P_2

time-consuming. Since we believe the derivation of this equation is important, we thought it best to include this with our other informative data that will be presented to you later. It is interesting to note, however, that in all the years we have been receiving catalogs and handbooks from spring makers all over the country, we have yet to see this standard derivation published. Oddly enough many of the manufacturers discuss in detail and derivation of the stress formula, and upon completion of this usually give the equation for calculation of coils without any

DERIVATION OF EQUATION FOR CALCULATING NUMBER OF ACTIVE COILS

EXTENSION AND COMPRESSION SPRINGS



When a round bar is subjected to torsion, the angle of twist θ is obtained from the well-known formula, $\theta = \frac{ML}{GJ}$, where M = the torsional moment, L = length of bar, G = Modulus of Rigidity, and J = Polar Moment of Inertia.

To find the deflection of a spring, consider a length dL. This length $dL = \frac{D}{2} d\alpha$ and is acted on by the moment $\frac{PD}{2}$, which causes a twist dθ. The point of application a of the load P will be swung through an arc ab with the result that the point of application has been lowered by the amount ac.

Let ad be the tangent to the arc at a. Since dθ is very small, we can consider the arc ab as being coincident with tangent ad so that the angle Pad = B where B is the angle at the section where twist dθ occurs between the radius $\frac{D}{2}$ and line Oa.

Hence: $ac = ab \cos B = oad\theta \cos B = \frac{oad\theta \frac{D}{2}}{oa} = \frac{D}{2} d\theta$

But the angle of twist $d\theta = \frac{MdL}{GJ} = \frac{P \times \frac{D}{2} \times \frac{D}{2} d\alpha}{G \times \frac{\pi d^4}{32}} = \frac{8PD^2}{\pi d^4 G} d\alpha$

$\therefore ac = \frac{D}{2} d\theta = \frac{4PD^3}{\pi d^4 G} d\alpha$

For the total length of spring L, the deflection F of the spring is

$F = \Sigma ac = \int_0^L \frac{4PD^3}{\pi d^4 G} d = \frac{4PD^3}{\pi d^4 G} \int_0^L d\alpha$

But $\int d\alpha$ = total angular distance in radians, subtended by the number of coils N, which equals $2\pi N$, hence: $F = \frac{4PD^3}{\pi d^4 G} \times 2\pi N = \frac{8PD^3 N}{d^4 G} = \frac{8PC^3 N}{Gd}$, or $N = \frac{FGd}{8PC^3}$ where $C = \frac{D}{d}$

further explanation. The equation for calculating the number of active coils is as follows:

$$N = \frac{FGd}{8PC^3}$$

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By a slight rearrangement of this equation, the rate of the spring equals:

$$\frac{P}{F} = \frac{Gd}{8C^3N}$$

★ ★ ★

It should be noted that the equations for stress S and number of active coils N are based on Hooke's Law, which states that load is directly proportional to deflection within the proportional limit of the material used. In normal spring design it is important that the value of S as calculated from the formula is kept below the proportional limit, otherwise spring failure or poor performance will result.

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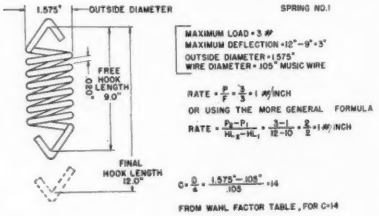
Now let us look at a few examples of extension springs: There are four extension springs before you, and you will note that the first spring is coiled open-wound.


1.575"
OUTSIDE DIAMETER
SPRING NO.1
MAXIMUM LOAD = 3 #
MAXIMUM DEFLECTION = 12"-9" = 3"
OUTSIDE DIAMETER = 1.575"
WIRE DIAMETER = .105" MUSIC WIRE
.020"
FREE HOOK LENGTH 90°
FINAL HOOK LENGTH 120°
RATE = P/F = 3/3 = 1 #/INCH
OR USING THE MORE GENERAL FORMULA
RATE = (P2-P1)/(HL2-HL1) = (3-1)/(12-10) = 2/2 = 1 #/INCH
C = D/d = (1.575"-.105")/.105 = 14
FROM WAHL FACTOR TABLE, FOR C=14
CK = 15.42
C³ = 2744
N = FGd/8PC³ = (3 X 12 X 10⁶ X .105)/(8 X 3 X 2744) = 57.5 COILS
S = PCK/.4d² = (3 X 15.42)/(4 (.105)²) = 10,500 PSI

That is, there is a space of approximately .020" between the coils. The dimensions for this

spring are given on our demonstration board. Now, if we apply a one-pound load to this spring, the spring will deflect 1″ to a hook length of 10″. If we apply a three-pound load, the spring will deflect 3″ to a hook length of 12″. The rate of this extension spring is determined by dividing the applied load P, for example, 3 lbs., by the deflection F, which, in this case equals 3″, the difference between the final extended hook length, 12″, and the initial free hook length, 9″. Hence the rate $= \frac{P}{F} = \frac{3}{3} =$ 1 lb./in.

★ ★ ★

It might be pointed out here that this definition of rate, namely, $\frac{P}{F}$, holds only when the spring is wound (as in this case) with an opening between coils. A more general definition would be $\frac{P_2-P_1}{HL_2-HL_1}$ where P_1 and P_7 are two different loads and HL_1 and HL_2 are the corresponding loaded lengths. For spring number one $\frac{P_2-P_1}{HL_2-HL_1} = \frac{3-1}{12-10} = \frac{2}{2} = 1\#/''$, the same result as before. This general formula has the advantage that it holds true for springs which do not have an opening between coils in their free position. One word of caution, though: it is necessary that at both loads, P_1 or P_2, there exists a space between coils.

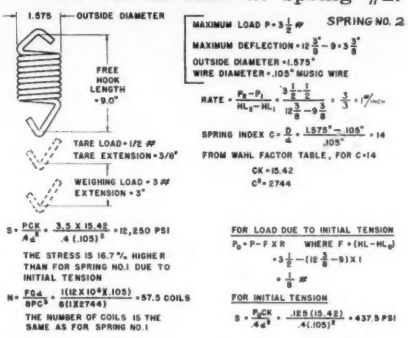
★ ★ ★

Using the equation for the number of active coils, $N = \frac{FGd}{8PC^3} = \frac{1 \times 11.5 \times 10^6 \times .105}{8 \times 1 \times 14^3} = 57.5$ coils

★ ★ ★

Using the equation for the stress, $S = \frac{PCK}{.4d^2} = \frac{3 \times 15.42}{.4(.105)^2} = 10{,}500$ psi. Summarizing, then, spring #1 has a rate of 1 lb./in., 55 active coils, and a maximum stress of 10,500 psi.

Now let us look at spring #2.


1.575
OUTSIDE DIAMETER
FREE HOOK LENGTH = 9.0"
TARE LOAD = 1/2 #
TARE EXTENSION = 3/8"
WEIGHING LOAD = 3 #
EXTENSION = 3"
MAXIMUM LOAD P = 3 1/2 #
SPRING NO. 2
MAXIMUM DEFLECTION = 12 3/8" - 9 = 3 3/8"
OUTSIDE DIAMETER = 1.575"
WIRE DIAMETER = .105" MUSIC WIRE
RATE = P2-P1 / HL2-HL1 = 3 1/2 - 1/2 / 12 3/8 - 9 3/8 = 1/3 = 1#/INCH
SPRING INDEX C = D/d = 1.575" - .105" / .105" = 14
FROM WAHL FACTOR TABLE, FOR C = 14
CK = 15.42
C² = 2744
S = PCK/Ad² = 3.5 X 15.42 / .4 (.105)² = 12,250 PSI
THE STRESS IS 16.7% HIGHER THAN FOR SPRING NO. 1 DUE TO INITIAL TENSION
N = FGd/8PC³ = 1(12 X 10⁶ X .105) / 8(1)(2744) = 57.5 COILS
THE NUMBER OF COILS IS THE SAME AS FOR SPRING NO. 1
FOR LOAD DUE TO INITIAL TENSION
P0 = P - F X R WHERE F = (HL - HL0)
= 3 1/2 - (12 3/8 - 9) X 1
= 1/8 #
FOR INITIAL TENSION
S = P0CK/.4d² = .125 (15.42) / .4(.105)² = 437.5 PSI

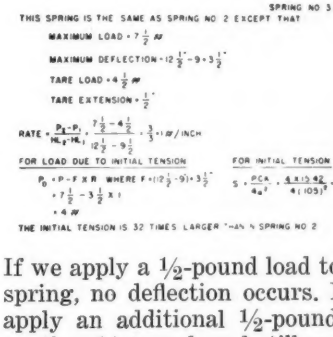
The physical dimensions, such as Outside Diameter, wire size, and number of coils, are identical with those of spring #1. However, you will note that this spring is coiled close-wound, that is, the coils touch each other. A certain amount of tension exists between the coils. This pre-tension is called "initial tension," and for some unknown reason, proves to be most troublesome to design engineers. If we apply a half pound load to this second extension spring, it will be noticed that all coils are free. If we now apply an additional 3-pound load to this spring, we will then obtain an additional 3″ in deflection, the rate $\frac{P_2-P_1}{HL_2-HL_1} = \frac{3\frac{1}{2} - \frac{1}{2}}{12\frac{3}{8} - 9\frac{3}{8}} = \frac{3}{3} = 1\#/''$, which is exactly the same rate as was found in spring #1. In other words, the spring rate is determined by physical dimensions only, such as Outside Diameter, wire diameter, and the number of active coils. The pre-tension, however, determines the total deflection for the maximum applied load, and has no effect whatsoever on the rate of the spring. You will note that spring #2 is considerably shorter than spring #1. This results from lack of space between coils in the free state.

★ ★ ★

To find the stress, the formula $S = \frac{PCK}{.4d^2}$ is used as for spring #1 except that the load P is now 3½ lbs. Hence, $S = \frac{3.5 \times 15.42}{.4(.105)^2} =$ 12250 psi. Thus the stress in spring #2 is 16.7% higher than in spring #1. If you want to find the amount of pre-tension in the spring before any external load is applied, you first calculate the axial force existing between coils. This force is equal to $P_0 = P -$ F x rate when P is the external load and F is the deflection due to external load. This deflection is measured from the free hook length of the spring. For spring #2, $P_0 = 3\frac{1}{2} - 3\frac{3}{8} \times 1 = \frac{1}{8}$ lb. Substituting this value of P_0 in the stress formula gives the pre-tension $S_0 = \frac{P_0CK}{.4d^2} = \frac{.125 \times 15.42}{.4(.105)^2} =$ 437.5 psi, a ridiculously low figure.

★ ★ ★

Now let us look at spring #3, which has the same physical dimensions as springs #1 and #2.


SPRING NO. 3
THIS SPRING IS THE SAME AS SPRING NO. 2 EXCEPT THAT
MAXIMUM LOAD = 7 1/2 #
MAXIMUM DEFLECTION = 12 1/2" - 9 = 3 1/2"
TARE LOAD = 4 1/2 #
TARE EXTENSION = 1/2"
RATE = P2-P1 / HL2-HL1 = 7 1/2 - 4 1/2 / 12 1/2 - 9 1/2 = 3/3 = 1#/INCH
FOR LOAD DUE TO INITIAL TENSION
P0 = P - F X R WHERE F = (12 1/2 - 9) = 3 1/2"
= 7 1/2 - 3 1/2 X 1
= 4 #
FOR INITIAL TENSION
S = PCK/.4d² = 4 X (15.42) / .4(.105)² = 16,000 PSI
THE INITIAL TENSION IS 32 TIMES LARGER THAN IN SPRING NO. 2

If we apply a ½-pound load to this spring, no deflection occurs. If we apply an additional ½-pound and another ½-pound, and still another ½-pound, we still do not have any deflection of the spring. Even by applying an additional half-pound load we do not obtain any deflection. However, if we apply a total of 4½-pounds, then deflection does occur and all the coils are free; that is, there is a space existing between each coil.

★ ★ ★

You will note that it is necessary to apply a total of 4½ lbs. before coils are free in spring #3, whereas in spring #2 only ½-pound was required. Also, we previously obtained 3⅜″ deflection with a total applied load of 3½ lbs. in spring #2. **Now** suppose we apply an additional 3 lbs. to spring #3; let's see what happens. We get 3″ additional deflection with this 3 lb. load, thereby giving the exact same rate as in springs #1 and #2. Note that we obtain a total de-

flection of 3½" with a total load of 7½-pounds, although the rate is identical with the other two springs. The importance of initial tension is obvious, since considerable space can be saved by coiling springs with pretension, which will absorb a considerable portion of the total applied load.

★ ★ ★

For example, in a weighing scale, the scale platform and levers are actually dead weights that are applied to the springs at all times. These are often of sufficient magnitude to cause more deflection than the usually applied load. Consequently, if no initial tension existed, the space required for tare deflection would be considerable, and in all probability would be very impractical.

★ ★ ★

To illustrate this point, here is a typical hanging scale having a pan for weighing food. You will note that the spring extension due to tare load of the scale parts is especially small. Scale springs are designed to give an opening between coils of approximately .020" after tare load is applied. If the springs were coiled without initial tension for this particular scale, the deflection due to tare alone would amount to 1¼", which would necessitate a larger scale casing.

★ ★ ★

Now getting back to spring #3, we can obtain the initial tension in the same manner as for spring #2:

$$P_0 = P - F \times R$$
$$= 7\tfrac{1}{2} - 3\tfrac{1}{2} \times 1$$
$$= 4\#\text{ initial tension}$$

where Tare Load = 4½#

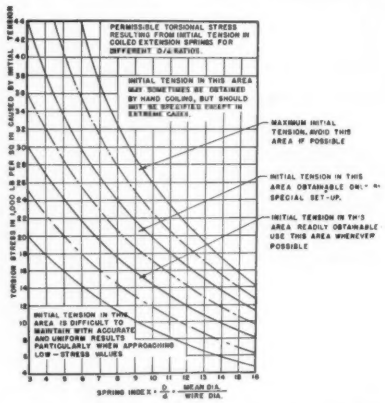
Tare Deflection = ½"
Additional Load = 3#
Additional Deflection = 3"

★ ★ ★

In spring #3, 4-pounds is the load due to initial tension. Therefore, $S_0 = \frac{P_0CK}{.4d^2} = \frac{4(15.42)}{.4(.105)^2} =$ 14,000 psi.

★ ★ ★

Spring #3 has $\frac{14000}{437.5} = 32$ times as much initial tension as


PERMISSIBLE TORSIONAL STRESS RESULTING FROM INITIAL TENSION IN COILED EXTENSION SPRINGS FOR DIFFERENT D/d RATIOS.
INITIAL TENSION IN THIS AREA MAY SOMETIMES BE OBTAINED BY HAND COILING, BUT SHOULD NOT BE SPECIFIED EXCEPT IN EXTREME CASES.
MAXIMUM INITIAL TENSION, AVOID THIS AREA IF POSSIBLE
INITIAL TENSION IN THIS AREA OBTAINABLE ONLY BY SPECIAL SET-UP.
INITIAL TENSION IN THIS AREA READILY OBTAINABLE USE THIS AREA WHENEVER POSSIBLE
INITIAL TENSION IN THIS AREA IS DIFFICULT TO MAINTAIN WITH ACCURATE AND UNIFORM RESULTS PARTICULARLY WHEN APPROACHING LOW-STRESS VALUES
TORSION STRESS IN LOGO LB PER SQ IN CAUSED BY INITIAL TENSION
SPRING INDEX = D/d = MEAN DIA. / WIRE DIA.

spring #2. In general practice, the maximum initial tension which can be produced economically depends on the spring index. Typical values are as follows:

Spring Index— D/d	Initial Tension PSI
4	27,000
8	17,500
12	12,000
16	8,000

★ ★ ★

The above values were taken from this graph, a copy of which will be included with other data. As noted, the initial tension should, if possible, be kept in the area between the two bottom curves.

★ ★ ★

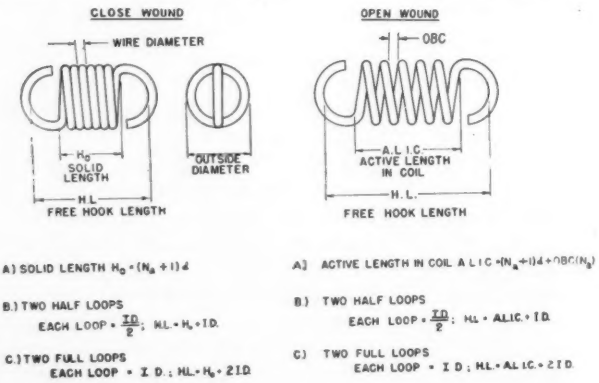
It is desirable to design extension springs close-wound if it is feasible, since the hook length can be controlled more accurately by so doing. Initial tension cannot be controlled accurately, and will vary from one coil to another in the same spring. The reason for this is that the spring wire twists slightly when being coiled on an automatic coiling machine, and also, variations in cast occur for each bundle of wire used. The cast is the permanent set given to spring wire when the wire is formed into the original size bundles. The smaller the original size of the bundle, the greater will be the cast and the more difficulty will be encountered in maintaining uniform initial tension.

★ ★ ★

Illustrated in Fig. 8 is the tabulation of formulas for calculating hook lengths of extension springs. For the spring coiled close wound and having half loops as shown on the spring at the left, the hook length would be equal to the active length in coil plus twice the inside diameter of the spring, the active length in coil being equal to the number of active coils plus one, times the wire diameter.

★ ★ ★

If the spring were coiled open wound, with a space between coils, as shown in the spring at the right on the screen, and had full loops, then the hook length would be equal to the active length in coil plus twice the inside diameter of the spring. The active length in


CLOSE WOUND
WIRE DIAMETER
H_0
SOLID LENGTH
OUTSIDE DIAMETER
H.L.
FREE HOOK LENGTH
A) SOLID LENGTH $H_0 = (N_a + 1)d$
B) TWO HALF LOOPS
EACH LOOP = $\frac{I.D.}{2}$; H.L. = H_0 + I.D.
C) TWO FULL LOOPS
EACH LOOP = I.D.; H.L. = H_0 + 2 I.D.
OPEN WOUND
OBC
A.L.I.C.
ACTIVE LENGTH IN COIL
H.L.
FREE HOOK LENGTH
A) ACTIVE LENGTH IN COIL A.L.I.C. = $(N_a+1)d + OBC(N_a)$
B) TWO HALF LOOPS
EACH LOOP = $\frac{I.D.}{2}$; H.L. = A.L.I.C. + I.D.
C) TWO FULL LOOPS
EACH LOOP = I.D.; H.L. = A.L.I.C. + 2 I.D.

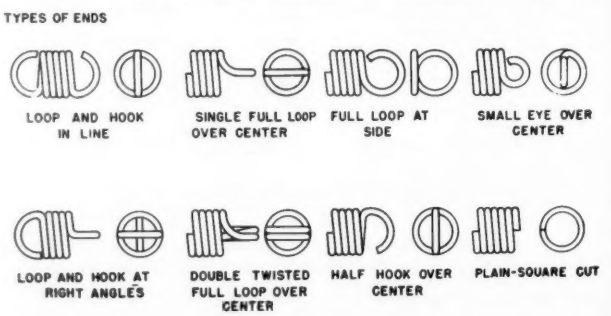

TYPES OF ENDS
LOOP AND HOOK IN LINE
SINGLE FULL LOOP OVER CENTER
FULL LOOP AT SIDE
SMALL EYE OVER CENTER
LOOP AND HOOK AT RIGHT ANGLES
DOUBLE TWISTED FULL LOOP OVER CENTER
HALF HOOK OVER CENTER
PLAIN-SQUARE CUT

Figure 8—Left. * * * * * * * * *

Figure 9—Above. * * * * * * * * *

coil in this case equals the number of active turns plus one, times the wire diameter plus the opening between coils times the number of active coils.

★ ★ ★

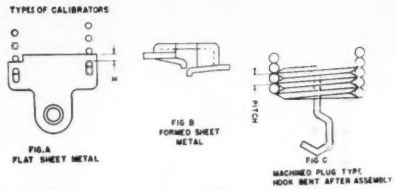
There is no limit as to the types of hooks that can be used for extension springs, as illustrated in Fig. 9 and the shape of the hook is usually determined by application requirements.

★ ★ ★

The three illustrations shown thus far have been of extension springs having a hook on each end. The rate of such springs is determined by the length of wire in each spring, which determines the number of active coils. If extreme accuracy is required, such as 5% tolerance on rate, manufacture becomes more difficult, especially if the spring hooks must have a definite relationship to each other. One convenient method of producing a precision extension spring in production quantities is to make use of an adjustable plug called a calibrator.

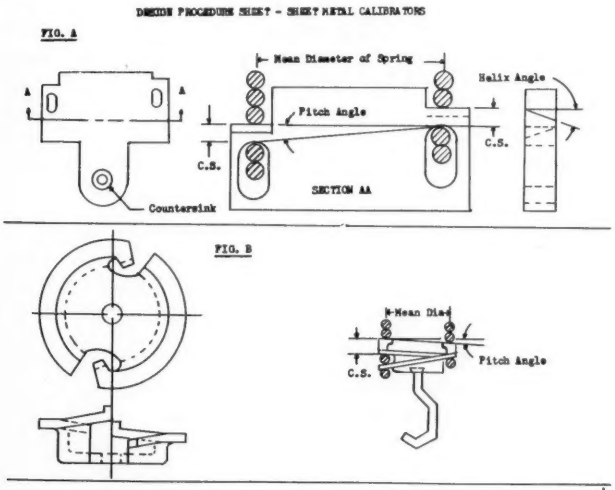
★ ★ ★

Calibrators can be in many shapes and forms, ranging from a flat sheet-metal calibrator, as illustrated in Fig. 10A, to a formed sheet-metal calibrator, as illustrated in Fig. 10B. For extreme precision, plug-type calibrators, as illustrated in Fig. 10C, are used. The advantage of using any of these types of calibrators for extension springs is for simple, accurate calibration of the spring rate. By turning the calibrator on the spring the number of active coils is varied; by reducing the number of active coils, the spring rate will stiffen, and by increasing the number of active coils, the spring rate will weaken. This can readily be deduced by referring to the previously developed formula for rate, namely, $\frac{P}{F} = \frac{Gd}{8NC^3}$. For a given spring, G, d and C are constants so that $\frac{P}{F}$ is inversely proportional to N, the number of coils. Also, it will be noticed that for the calibrators made to the designs illustrated in Figs. B & C, it is unnecessary to be concerned with the position of hooks, since the hook attached to the calibrator swivels.



Another important advantage with this type of construction is that the attachment hook can be bent, after assembly and calibration of the spring, to the desired hook length. The design of these calibrators, however, is a very important matter, since complications can develop with improper design of calibrators. To illustrate the troubles that can develop, suppose the calibrator in Fig. A is not designed properly, and that the distance X from the top of the hole were less than the maximum deflection of an individual coil. Then the coil would leave the calibrator before the total load was applied to the spring. Consequently the number of active coils in the spring would change, resulting in a change in rate. The same condition would exist with calibrators as illustrated in figures B and C. Our demonstration board illustrates the various formulas that are used in designing these types of calibrators, but here again, we will not show illustrative problems at this time, but will distribute these to you at the completion of the discussion. We might point out that if the design is not in strict accordance with the proper method of designing calibrators, errors will be introduced. Always be ex-

(*Please turn to page* 207)



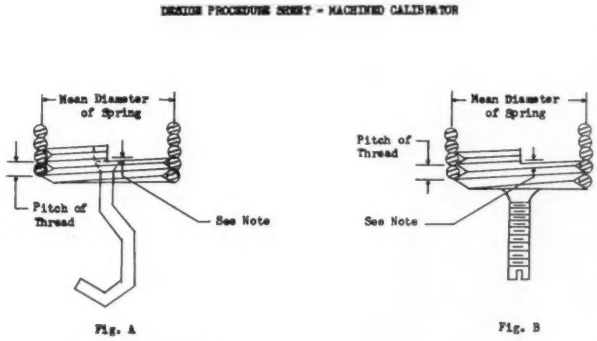
CALCULATIONS FOR SHEET METAL CALIBRATORS

(1) Calibrator Maximum Opening = $\frac{\text{Maximum Deflection}}{\text{Number of Active Coils}}$

(2) Add 10% to Maximum Coil Opening figured in (1) -- this will give Coil Spreader Height (C.S.)

(3) Coil Pitch Spring Angle = Tangent $\left(\frac{\text{Wire Diameter}}{\text{Mean Diameter}}\right)$

(4) Calibrator Coil Pitch Angle = Tangent $\left(\frac{\pi \times \text{Wire Diameter}}{\text{Mean Diameter}}\right)$



CALCULATIONS FOR CALIBRATOR

(1) PITCH OF THREAD

(a) Calibrator Maximum Opening = $\frac{\text{Maximum Deflection}}{\text{Number of Active Coils}}$

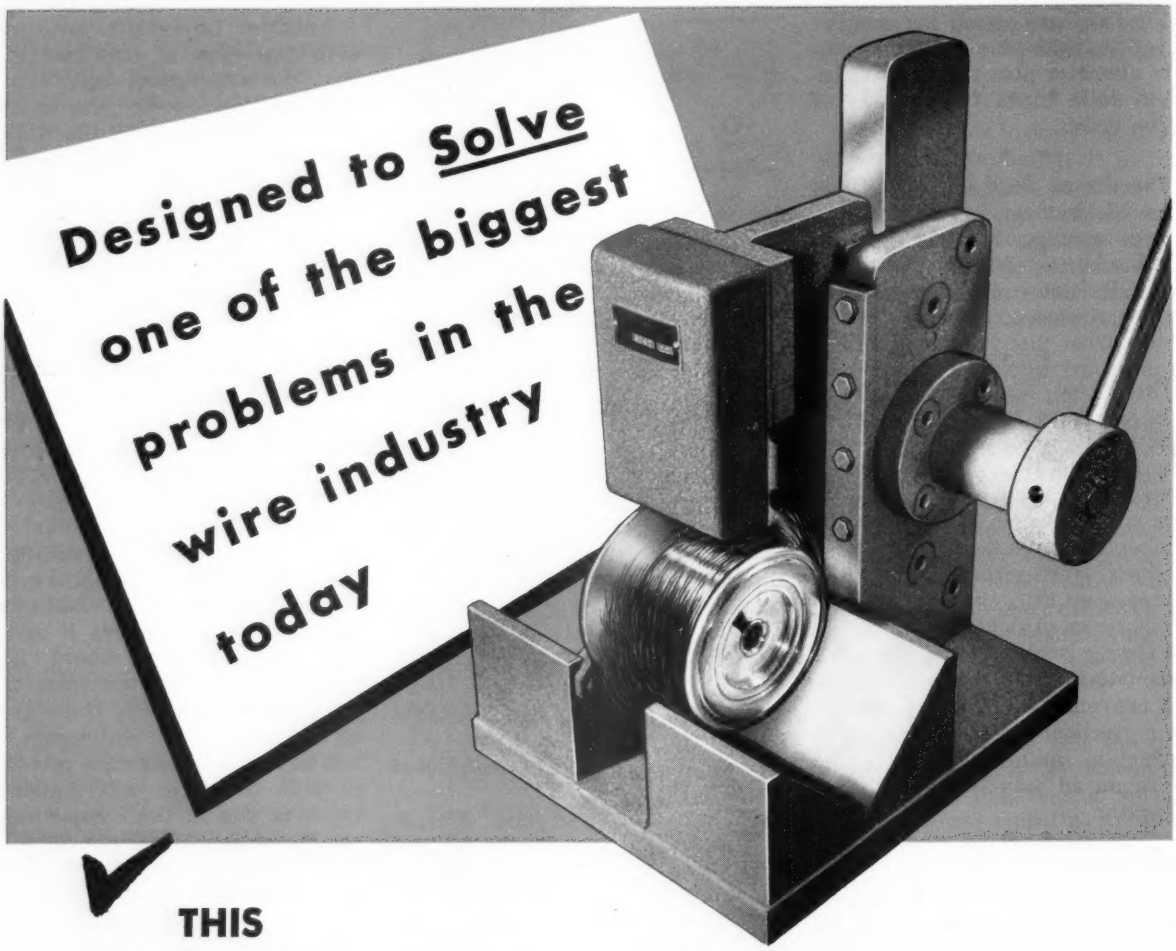
(b) Add 10% to Maximum Coil Opening figured in (a) -- this will be the Pitch of Thread

(2) PITCH DIAMETER OF THREAD = OD - 3d - (.866 P)

Where:
OD = Outside diameter
d = Wire diameter
P = Pitch of thread

Note: This step of approximately .010" insures the coil having a definite leaving point on the calibrator, whereby the number of active coils remains constant.

The above method of designing calibrators is applicable to Compression Springs also with the exception that either the hole (Fig. A) or the screw stud (Fig. B) is omitted.



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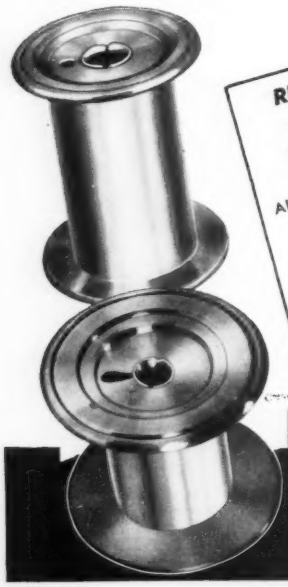

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The Manufacture of Rivets and Screws

by T. S. Merriman
Metallurgist and Process Engineer
Waterville Division
Scovill Manufacturing Company
Waterville, Connecticut

This very interesting paper on production technique of non-ferrous fastener manufacture was delivered at the annual Convention of The Wire Association in Chicago, Ill., on November 10, 1953.
We are especially grateful to Mr. Merriman for his kindness in accepting a call to fill in with a talk on this subject, which was scheduled to have been given by Victor Caltham of the Milford Rivet and Machine Co., but from which assignment he found it necessary to withdraw just before the Convention.
Mr. Merriman, familiar with the subject, from a few notes put together in the limited time at his disposal, gave a splendid extemporaneous lecture that was recorded stenographically and is reproduced here.
The discussion following his talk appeared in the January issue of Wire and Wire Products.

Mr. Wood has said that I am a process engineer and metallurgist, and that is true. However, trouble is my business. I will try today to give you a little understanding of the equipment which is used in the manufacture of screws and rivets, and we will go into the tooling for the production of such products to whatever extent time permits.

★ ★ ★

I am glad to be here today to present the viewpoints of a screw manufacturer to a group of wire producers and to people who produce products which are associated with the wire industry. It has seemed to me and to a great many others in this screw producing industry, that there is an increasing need for improved understanding of the screw manufacturers' problems. This is because during the past ten to fifteen years, there has been a very great change in the type of product produced by cold heading.

★ ★ ★

During World War 2, when automatic screw machine capacity was very, very short, some enterprising men discovered that the same products which are normally made on automatic screw machines, could be fabricated by cold heading; faster, to reasonably close tolerances, and with a great saving in raw material required.

★ ★ ★

Since World War 2, production volume has increased and the variety of head styles made today is almost unbelievable. I have on the table a group of samples, which were gathered originally for distribution by our sales people. They illustrate some of the types of screws which are made today.

★ ★ ★

Admittedly, my company specializes in the more difficult heading jobs. Consequently, we can't make an over-all statement that all screw producers are making this type of work. That would not be so. However, by and large, all screw producers are doing a better job today than they have ever done before.

★ ★ ★

Along with the impetus given cold heading during the war, there has been another factor in the manufacturing techniques for the production of bolts and screws which affects the wire used for these products. That is a very strong tendency to produce threads by roll threading rather than cut threading. We will touch on roll threading a little later.

★ ★ ★

The basic machine for the manufacture of the screws and rivets is a cold header. Essentially, the cold header is a horizontal press. It is equipped to feed in coiled wire, to cut off the wire to a preestablished length and to upset in a die or dies, a portion of the cut wire with one, two or a series of blows.

★ ★ ★

Further refinements of this basic machine make it possible to trim heads, point ends and roll threads on a single piece of equipment. The speeds of these machines may vary from approximately 30 pieces per minute to 250 or even better on certain special applications.

★ ★ ★

There are two basic types of cold headers, solid die and open die. Their purpose is of course, the same. The machines used for secondary operations are, with the exception of roll threaders, not limited to the manufacture of bolts and screws. That is, we use slotting machines, turning or shaving machines, pointers (two styles at least) cross drillers, bolt trimmers and reheaders.

★ ★ ★

As its name implies, a reheader is a cold heading machine which normally track feeds a partially completed screw blank to a die where one or two blows progressively form the head.

★ ★ ★

Bolt trimmers of the old type are track fed machines whose usual purpose is to trim screw or bolt heads to square, hexagon, pentagon or other shapes desired. It

is commonly used to extrude reduced sections for threading. Of course these operations could readily be formed on an upright press although the feeding arrangements would be rather more difficult.

★ ★ ★

There are at least two basic types of pointing machines used in the fastener industry. One of these is essentially a machine for turning a point. This is especially equipped for the fast and efficient handling of screw or bolt blanks. The other type of pointer is called a pinch pointer and is designed to produce a point such as that commonly found on nails. This is done by the shearing action of a pair of dies. In certain plants, this type of equipment has been highly specialized so the rate of production is very, very rapid.

★ ★ ★

I might add that the necessity for pinch pointing is brought about by the very greatly increased demand for gimlet pointed tapping screws. I think you are all familiar with tapping screws today. Some ten to fifteen years ago their usage was quite small. Today, it is very large. As a matter of fact, the automotive industry would be seriously handicapped today without tapping screws.

★ ★ ★

Screw slotters, are track-fed machines arranged with an indexing dial and either a single saw or multiple saws, for slotting screw heads. The saw may be fed for a plunge cut or the work may pass under a fixed saw, giving the effect of a milled slot.

★ ★ ★

Cross drillers are specialized machines designed for the efficient cross drilling of heads or shanks of screws and bolts. These holes usually are intended for the insertion of lock wires or cotter pins. The usage of screws of this type is decreasing because of the increased usage of lock nuts and lock washers of various types.

★ ★ ★

The most common type of of machine used for the mass production of roll threaded screw and bolt blanks is of simple design. The blanks are either hand or track fed through a pair of threading dies on the faces of which is milled or ground the desired thread form. One of these dies is fixed while the other moves parallel to the face of the first die in a lateral direction, thereby rolling the blank between the dies and forming the thread.

★ ★ ★

Other newer types of equipment use cylindrical dies, usually three in number. A variation of the latter equipment includes a multiple arrangement of such dies so that blanks having different lengths and pitches can be selectively fed and threaded at the same time.

★ ★ ★

The operations peculiar to the manufacture of screws are the cold heading and the roll threading. It is these operations which sorely tax the best wire available and make rivet men old before their time.

★ ★ ★

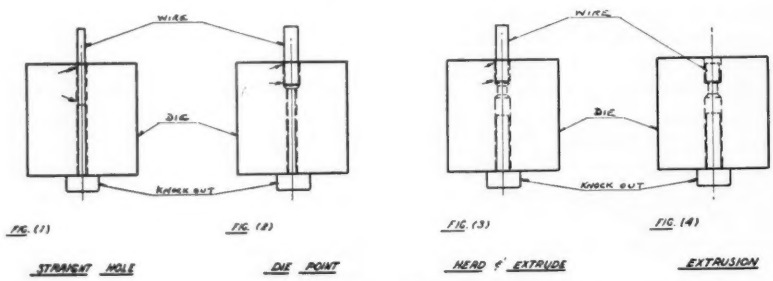
Let's consider the tools involved in the heading or upsetting operation. The first bit of equipment which enters into the cold heading is the feed mechanism. If you wonder why I point out the feed mechanism or the method for paying in wire to the header, it is simply because there has been misunderstanding, by wire producers of the screw manufacturer's request for having wire coiled on arbors of certain specified size. There is a logical reason for this. Some headers are equipped with straightening rolls. However, more commonly, there are no straightening rolls. Consequently, a coil of very small diameter would retain some of the original cast of the wire and it could cause the header man trouble. A slight bend in the wire might cause shearing as the wire enters the die. You must understand that in many cases, the clearance between wire diameter and the die diameter is a matter of approximately two-thousandths. It is a pretty small clearance and a very slight bend can cause failure to feed properly.

★ ★ ★

Some wire producers have had rejections because of kinked wire. It has to do with the same sort of trouble. The wire passes through feed rolls without a straightener and immediately jams in the shearing mechanism which the header man calls a quill or cutting tube.

★ ★ ★

There is very small clearance on the cutting tube to get a reasonably square cut off and a kink cannot be fed completely through this tube. The result is what the header man calls a short feed, and a blank made from a short feed cannot be properly ejected from the die. Of course, that means a smashed set of tools and a disgruntled toolsetter.



Basic Types of Heading Dies

There is an infinite variety of sizes and types of cold heading dies. Above are illustrations of four basic types of dies. The straight hole die is used for the production of common garden variety round head screws and the like. Figure 2, is what we call a die point die. Figure 3, is a heading and extruding die. Figure 4, is a die which is used for a first operation extrusion. A blank made on the die of this type would normally pass through reheading operations in order to form a finished

head.

★ ★ ★

I would like to take up these dies in a little more detail because the mechanics of heading are illustrated by these types of dies.

★ ★ ★

The straight hole die is simple. When the wire enters the die, you have a bit of wire protruding from the die as shown. On a double stroke single die header, that protruding portion of wire would be upset in two blows. That is a simple upset and is done on the face of the die. The normal tendency is to expand slightly at the points of greatest pressure (see arrows on illustration). Consequently the central section of the blank will not be completely filled out. That is particularly true of long blanks. The shorter the blank, the better the header man's ability to fill the shoulder completely. The inability to fill out a blank is one reason why some of your wire customers want close tolerance wire. Because this portion of the screw will finally be roll threaded and because the requirements today are exacting, the wire must be close to size entering the die in order to produce a quality blank.

★ ★ ★

You will see, of course, in a die of the second type that you have a point of stoppage at the top of the point angle. The wire will have a portion protruding which will subsequently be upset in two blows. However, at the abrupt stopping point, you have a definite swelling. Again, the bulk of the work is done on the face of the die itself, a simple upset. These dies are different only because of the point.

★ ★ ★

Here on the heading and extruding die, we have a different proposition altogether. The extrusion is normally made to permit roll threading. That is, this wire diameter will be approximately the final shoulder diameter of the screw. The choke diameter will be approximately the pitch diameter of the finished screw. For the smaller sizes of screws from No. 8 possibly through 3/8, this reduction on the diameter will be on the order of a thirty-second of an inch, or .016" on a side. Throughout the industry, the extrusion is pretty well standardized. It is a 30 degree angle. It has been found that wire will extrude most easily on that angle. When you consider the mechanics of this type of heading, you have a rather difficult proposition. The wire enters, immediately hits the extrusion angle near the top, and the speed of the blow extrudes the wire through the choke diameter into the relief down to the knockout pin. The blank will subsequently be ejected, and the choke diameter will be ironed out.

★ ★ ★

This extrusion really brings the quality of the wire right out in the open where you can see it. Either brass or steel wire with an unusually rough finish does not extrude properly. There is excessive friction and a resulting tendency to extrude only part way. This condition usually increases tool breakage.

★ ★ ★

Lubrication is another major factor in this type of operation. In our own shop for many years we used white lead with machine oil for a lubricant. We have had to get away from it because of the toxic qualities of white lead. However, in our experience, white lead acted not only as a lubricant, but also as a coolant. It is highly desirable that the lubricant used in a heading operation where there is an extrusion performed have both those qualities. That is, it should have good film strength in order to prevent metal to metal contact and second, should have a cooling effect in order to preserve the die.

★ ★ ★

Of course, the head styles produced by this method will be of the same general type as those produced on the other dies. The extrusion is the distinguishing feature, combined with the upset on the face of the die.

★ ★ ★

I would like to consider the die shown in Figure 4, which is a little uncommon. It may be new to some of you who currently produce screws. It is a simple extrusion die. However, its mechanical principle is entirely different. Here there is no unsupported length of wire. The blank must be entirely supported by the sidewalls of the die. The sole purpose, of course, is to extrude, thereby providing stock for unusually large heads. We normally extrude on a radius and the reductions which are possible are amazing. In our own plant, reductions of fifty thousandths of an inch or more on a side are commonly made. These are great reductions and of course, they can be accomplished only by enclosing the blank completely and doing the work with the punch pin, which has to enter the die.

★ ★ ★

Now, it can be readily seen that with reductions of that order, the surface quality of the wire has a very important bearing on the success or failure of the operation.

★ ★ ★

The above dies make only part of a blank. The balance of the blank is made with a punch. Discussion of head formation gets into a subject that has been argued by a great many people for a very long time. I recall some years ago when the production of Phillips recessed head screws was under a prime licensor, it was quite common to give screw producers blueprints of first blows (first upsets, or coning blows) to produce certain types of heads. I have seen engineers, time after time, receive the blueprints, shake their heads, file them in their brief cases, take them home, file them in the cabinet, and never look at them. There is a reason for that behavior.

★ ★ ★

The first blow which will make a satisfactory head varies widely from lot to lot with the raw material. I can't give you any formula for the proper formation of the first blow because there is none. Our rivet makers have to tailor the blow for a given job for the raw material received. There are similarities, yes, but identical re-

(*Please turn to page* 203)

Results of Research on Rubber Insulated Wire

by John T. Blake
Director of Research
Simplex Wire & Cable Co.
Cambridge, Massachusetts

The last dozen years have seen significant changes in the use of rubber in the construction of wires and cables. Before the war there was no substantial synthetic rubber industry in this country. There was only a minor use of neoprene for jackets on portable cords and cables where resistance to oil was important. Today synthetic rubbers are used extensively in the construction of insulated wires and cables.

★ ★ ★

In the wire industry the proportion of synthetic rubber used is greater than in any other branch of rubber manufacture. Our large consumption of neoprene is due not so much to newly developed properties as to the substantial reduction in price brought about by large scale production during the war. This enabled us to take advantage of its properties without having to pay a too severe price penalty. GR-S and butyl rubber are used in insulations because they give properties superior to those that can be obtained with natural rubber.

★ ★ ★

As synthetic rubbers are improved, it is probable that practically no natural rubber will be consumed in wire manufacture.

★ ★ ★

The figures of Table I are interesting as a demonstration of the extent to which natural rubber has been replaced by synthetic rubber in the wire industry. For 75 years, natural rubber was practically the only solid flexible insulation. Today it constitutes only a small fraction of the rubber used.

Dr. Blake is a native of Boston. He graduated from Tufts College in 1921 and received his Ph.D. in organic chemistry from M.I.T. in 1924. He joined Simplex Company in 1924 as a research chemist, was made Director of Chemical Research in 1935 and Director of Research in 1940. He is the author of many technical articles dealing with rubber and served with the War Production Board during World War II. In 1953 he was named the Charles Goodyear Lecturer for the Fall Meeting of the American Chemical Society in Chicago. The paper published here was delivered on November 11th in Chicago at the annual convention of the Wire Association.

This is in spite of the fact that at times during this period the price of natural has been below that of synthetic. It would take a fairly large price differential in favor of natural rubber for us to revert to its use. We would wish to maintain the improved quality available with synthetic rubber even at a higher price.

Table I

Consumption of Natural Rubber As Percentage of Total Rubber

	National	Wire & Cable
1946	27%	12%
1947	50%	17%
1948	59%	25%
1949	58%	21%
1950	57%	21%
1951	37%	8%
1952	36%	8%
1953 (6 mos.)	40%	10%

In discussing the preference for synthetic rubber in the wire industry it is necessary to consider the qualities that are essential for maximum serviceability of the product. We can disregard some properties which appear prominently in many of the specifications to which rubber insulated wire and cables are manufactured and purchased. These practices have grown up over a long period of time and may have little to do with the technical quality of the product. The purchaser wants, as a practical matter, a wire or cable which can be installed without damage and which will withstand the various hazards of its use. It should have suitable physical and electrical properties originally and they should persist during long exposure to the various deteriorating influences in service. Most wires and cables are expected to have a long service life, perhaps longer than is considered essential for almost any other rubber product. Obviously no two installations will be subjected to the same deteriorating influences or to the same extent during the life of an installation. In the manufacture of rubber wires and cables, one must provide for many contingencies.

★ ★ ★

There are four electrical properties of rubber insulation which are of importance. The dielectric strength should be high enough to ensure that electrical breakdown will not occur either during normal operation or under the surge voltages which develop frequently on power systems. The dielectric resistance should be sufficiently high to prevent large leakage losses. Actually most specifications demand resistance values, as a measure of quality, which are greatly in excess of service needs. For both power and communication service the dielectric constant and power factor should be low so that the charging currents and losses will

not be excessive. There should be a proper balance between these properties for a particular cable installation.

★ ★ ★

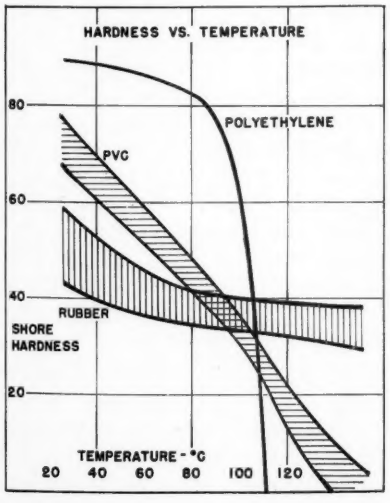
The physical properties necessary for rubber insulation depend on the specific service conditions. Tensile strength and elongation are commonly used as criteria of quality. Tensile strength is, in itself, of little significance as a measure of practical serviceability. Elongation values of 100% would be adequate for practically all rubber compounds. Most specifications demand much higher values. The principal use of tensile and elongation values is as a tool in the study of changes produced by deteriorating influences.

★ ★ ★

The real physical property needed in electrical insulation is toughness so that it may withstand installation and service conditions. Tear, abrasion, compression resistance and modulus are all partial measures of toughness. There is probably no single measurable property which represents this quantitatively. One measure of toughness is the extent to which an insulation resists deformation over a wide range of temperatures. Obviously we would like this and other properties to be independent of temperature but this ideal is never reached.

★ ★ ★

Hardness is also a measure of deformation and in Figure I values are plotted against temperature.



It is obvious that polyethylene has a rather sharp temperature ceiling above which it becomes completely unsatisfactory. The relative stability of rubber insulations in this respect is one reason why we are such large users of rubber.

★ ★ ★

There are a number of environments to which rubber compounds in wires and cables may be exposed. Efficient operation of a power cable demands high current loading. Heat is evolved so that an insulation may be exposed to high temperatures for long periods of time. Rubber power cable insulation must have, therefore, excellent resistance to aging at high temperatures. Copper operating temperatures are probably 20 to 30 degress Centigrade higher than they were 20 years ago. Rubber insulation and jackets must withstand long exposure to sunlight without deterioration. Many cables must resist exposure to various oils and chemicals.

★ ★ ★

Many cables are laid in rivers, harbors and oceans for various submarine services. Cables laid in the ground are also exposed to water at some portions of their length. Until fairly recently it was necessary to protect rubber insulations for these purposes with lead sheaths to prevent the deterioration of electrical properties through the absorption of water. With the development of low water absorption rubbers, it has become possible to eliminate lead sheaths and it is now customary to expose rubber insulation directly to water or to bury them in the ground without metallic protection.

★ ★ ★

Rubber insulations exposed to water have the essential requirement that their electrical properties shall not deteriorate materially through water absorption. In any given type of rubber, the smaller the amount of water absorbed the less will be its effect on the electrical properties. In different types of rubber compunds, however. the deterioration caused by the absorption of a given amount of water may vary. This can be determined reproducibly by capacitance gain measurements. Some of the more advanced specifications now set limits on both the actual amount of water absorbed and the increase in capacitance during an accelerated water exposure test.

★ ★ ★

Water absorption is increased by oxidation. GR-S has greater resistance to oxidation than does even deproteinized natural rubber. For this reason the newer low water absorption varieties of GR-S and butyl rubber furnish much more desirable low water absorption insulation because their properties remain stable under oxidizing influences.

★ ★ ★

Rubber insulated and jacketed wires and cables must withstand aging influences for long periods of time. Synthetic rubbers are undoubtedly much more long-lived than natural rubber. We have now nearly 10 years of service experience. In general this confirms the data obtained in accelerated aging tests. It is a problem to relate exactly accelerated tests to service conditions since the latter vary so widely.

★ ★ ★

On the other hand, it is safe to say that rubber insulations and jackets which withstand such tests better than other rubber compounds will last appreciably longer in service. Figures II and III show the behavior of the principal types of rubber insulations and jackets in accelerated tests. It is evident that insulations from GR-S and butyl rubber and jackets of neoprene and GR-S are far better in their predicted life than the best natural rubber compounds. The use of synthetic rubber in wires and cables gives the customer more for his money on a long-range basis.

★ ★ ★

Specification tests must necessarily involve short times of exposure to the accentuated conditions. This is because manufacturing operations and the customer cannot wait for longer tests. Evidence is accumulating that many specification tests, particularly

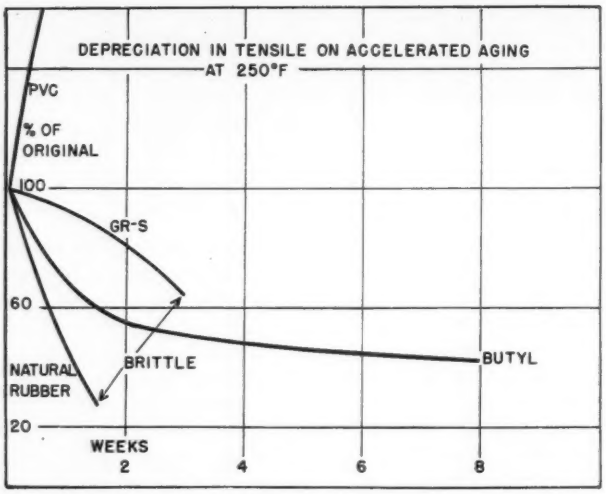


Figure II.

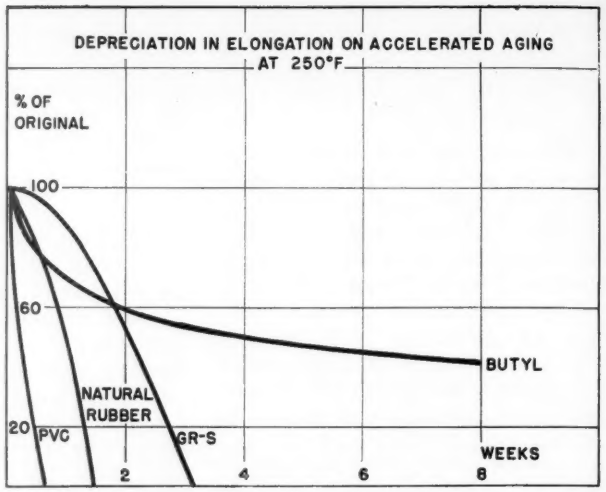


Figure III.

those related to aging may be misleading. The shape of the curves of deterioration against time may differ appreciably. Many times the deterioration for a short period may be greater in one compound than in another and yet over longer periods the situation is reversed.

★ ★ ★

The aging of butyl compounds at 250° F., for example, gives a curve which decreases sharply in the first few days but then shows practically no decrease during several months of additional exposure. Natural rubber compounds may not deteriorate as rapidly as GR-S in the first portion of the test, yet become brittle after only a short additional time.

★ ★ ★

In Figure IV deterioration curves are shown for two GR-S compounds of similar composition.

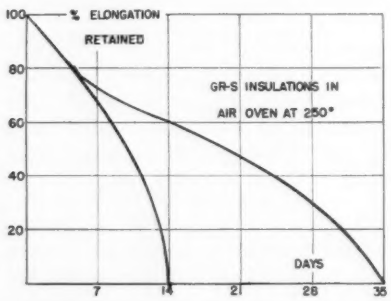


Figure IV.

After 7 days exposure to air at 250° F. the two have deteriorated to the same extent and the obvious conclusion would be that they should age equally well. Results obtained in shorter periods of time would probably lead to the same conclusion. If these tests are continued until the samples become brittle, which is a truer measure of the useful life, a sharp contrast is produced. One compound is brittle in 14 days, the other does not become brittle until 35 days have passed. In spite of the fact that the two look to be equal after 7 days one has a real life that is probably 150% greater.

★ ★ ★

This points out a serious deficiency at times in such tests. It emphasizes the fact that in development work, at least, accelerated tests should be carried to the point where the material has become useless. A real problem exists as to how both the manufacturer and the purchaser can specify properly a suitable means for ensuring maximum quality.

★ ★ ★

In recent years evidence has been produced indicating that ozone in the atmosphere is the principal agent responsible for the so-called sun-cracking of rubber. Ozone is normally present in the atmosphere to the extent of 4 to 6 parts per hundred million. It is believed that ozone is generated by ultraviolet radiation in the upper atmosphere and that air currents bring it down to ground level where it is gradually decomposed. Dust particles in the atmosphere are active agents for such decomposition and many times the ozone concentration in cities is lower than in rural areas. Accelerated tests for atmospheric cracking using ozone concentrations of 25 to 30 parts per hundred million have been very valuable in developing rubber compounds to resist this deteriorating influence. An acceleration of 5 to 6 times in this test has been regarded as very satisfactory.

★ ★ ★

Recent studies in the Los Angeles area indicate that an extraordinary atmospheric cracking condition exists there. The cracking effect in smog is at times equivalent to that in concentrations of 30 to 50 parts per hundred million of ozone. These values are higher than the ones used in the standard accelerated test. It has been shown that in this region ozone can be formed in the lower atmosphere. Nitrogen peroxide functions as a catalyst whereby sunlight acting on traces of hydrocarbon and other organic chemicals in the air generates atomic oxygen and nitric oxide. The atomic oxygen combines to form ozone which attacks rubber to crack it. The geographical configuration of the Los Angeles area allows a stagnation of the air which accentuates the effect.

★ ★ ★

The Bell Laboratories have shown recently that an additional factor may contribute to the cracking of rubber. They have demon-

strated that volatile peroxides exposed to ultra-violet light can cause cracking of rubber even without the presence of oxygen. This action is attributable to the generation of chemically active free radicals which produce the same type of physical degradation as ozone. The formation of ozone in the atmosphere at lower levels and the fact that atomic oxygen and free radicals may produce physical effects which had been attributed only to ozone demonstrate that our concept of suncracking needs modification.

★ ★ ★

High-voltage cables which have air spaces in the electric field are subjected to corona. Corona discharges in air generate ozone. Both ozone and corona cut ordinary rubber compounds. Because of the similarity of corona cutting and ozone cutting it has been assumed that rubber compounds which resist cracking in ozone would be suitable for high-voltage insulation. Recent work indicates that some rubber insulations which resist cutting in ozone will cut under the influence of corona. In addition to the physical erosion that corona can produce, there is another factor in a corona discharge. We have indications that atomic oxygen can cut rubber. We know that atomic oxygen is present in corona discharges at low pressures. It may also be present at atmospheric pressure. High-voltage insulations should therefore not only be tested for ozone resistance as in the past, but it is imperative that they be tested for resistance to corona discharges as well.

★ ★ ★

The so-called cold rubbers which are GR-S polymerized at lower temperatures are relatively new. When suitably compounded they produce insulations with appreciably better physical properties than can be obtained with GR-S made at the standard temperature. Probably most of the GR-S used in the wire industry in the future will be polymerized at these low temperatures. It may turn out that these cold rubbers will be of even more value in the wire industry than in other branches of rubber manufacture although they have extensive use in these fields.

★ ★ ★

A development of the past two years which is still in its infancy is the extension of GR-S by oils and other materials. GR-S is polymerized to as high a Mooney plasticity as possible without producing cross-linking and then diluted with a suitable mineral oil, to the standard plasticity. As much as 25 to 40 parts of oil can be added. This forms a product which has essentially the same properties as the regular material. Since the oils used are cheap a reduction in price of about 20% may be obtained. This is a substantial saving and such rubbers are being used extensively in tires. There is evidence also that an improvement in quality may be obtained at the same time. Some experimental rubbers have been diluted with nearly an equal volume of oil without appreciably reducing their quality. Little attention has been paid to this field in wire and cable manufacture but it has interesting possibilities.

★ ★ ★

Neoprene is capable of being treated in a similar manner and there are indications that substantial savings may be procured without loss of satisfactory physical properties. In this case, however, flame resistance is decreased. In many applications this is undesirable. Little has been done with butyl rubber in this respect but there may be advantages with this material as well.

★ ★ ★

There is another feature of the use of synthetic rubber which is of importance both from a quality point of view and commercially. Before the war we purchased only the top quality of plantation rubber. The slightest traces of dirt or foreign material are likely to cause electrical failures. In order to produce satisfactory electrical insulation we were forced to use an expensive inspecting and segregating procedure and then wash and dry the rubber. In addition systematic blending of various lots had to be used to produce as uniform a product as possible. With synthetic rubber the cleanliness of the product and its uniformity allow us to eliminate these operations completely. The result is a more uniform and reliable product.

★ ★ ★

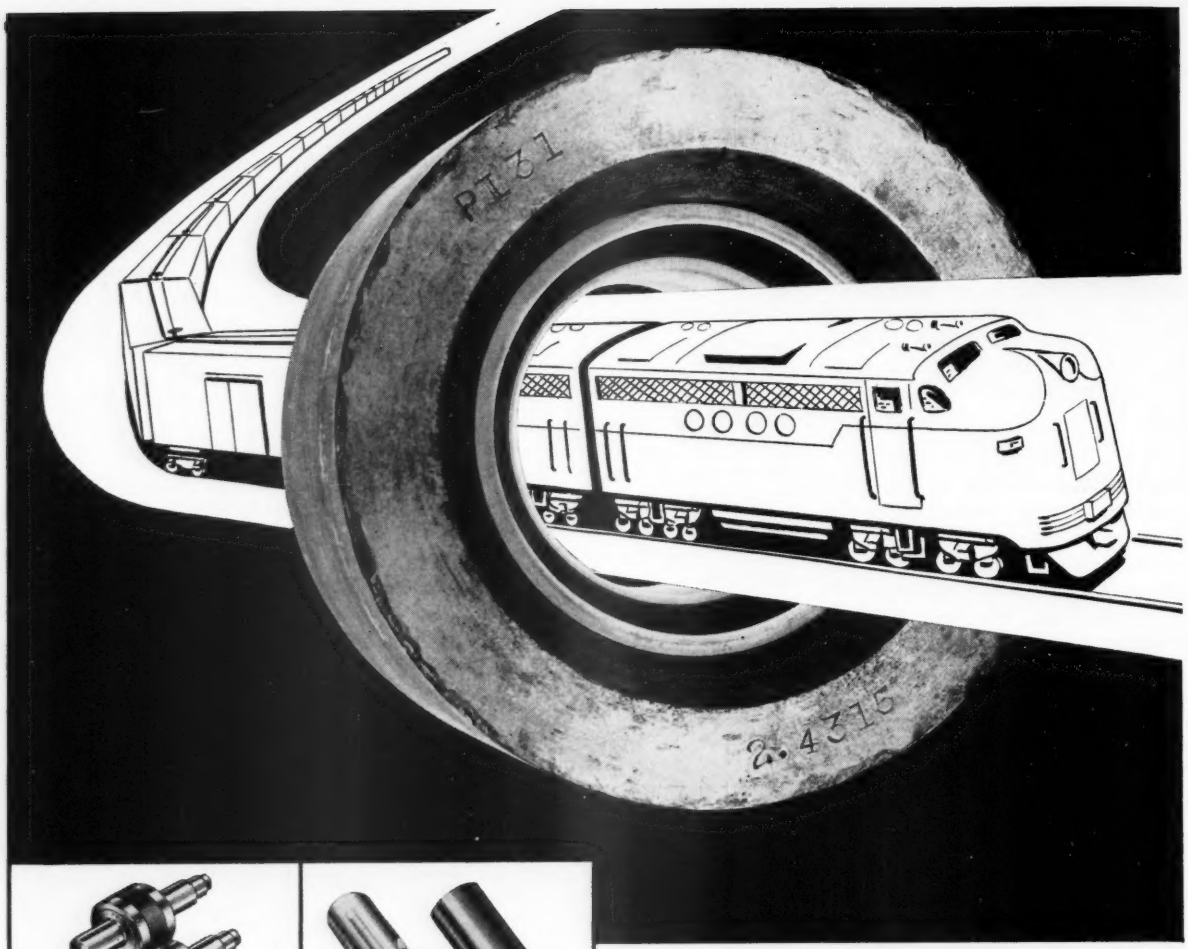
Butyl rubber is proving to be a most desirable material for wire insulation. The unsaturation of rubber, i.e., the presence of double bonds in the molecule, is what makes it susceptible to degradation by heat, oxidation and ozone. The double bonds are the points of attack. Butyl rubber holds much promise for long-lived insulations and insulations where high temperatures are encountered either from the environment or from high current loading. Since the unsaturation of butyl rubber is only about 1/30 that of either natural rubber or GR-S we have an excellent headstart in the compounding of butyl rubber to resist ozone. Quinone dioximes and their derivatives are excellent vulcanizing agents for butyl rubber. They produce compounds with greater ozone resistance than conventional accelerator and sulfur combinations. The explanation for this is not clear. It is possible that because there are relatively few double bonds in butyl rubber, inter-bond distances are greater than in either GR-S or natural rubber. The larger molecular size of these new vulcanizing agents may make it possible to reduce the unsaturation further than can be done by sulfur vulcanization.

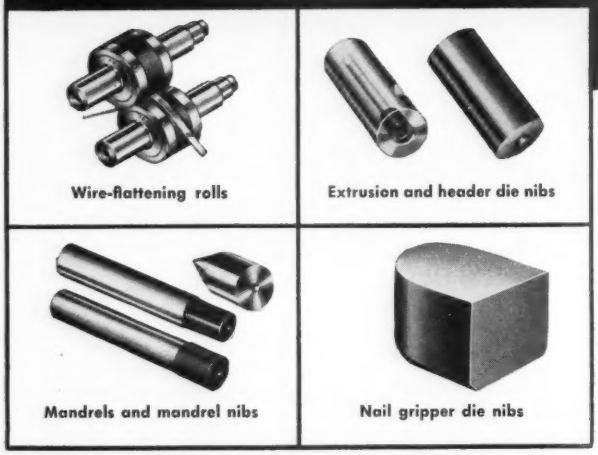
★ ★ ★

Butyl rubber is made by mass polymerization, instead of emulsion polymerization like that used for GR-S. The non-hydrocarbon constituents are at a minimum. Butyl rubber has, therefore, inherently low water absorption and is fundamentally adapted for underwater and underground cable insulations. Particular attention must be paid to the selection of compounding ingredients for the inherent virtues of butyl rubber to be utilized fully.

★ ★ ★

Some six years ago we discovered a cable insulated with low water absorption rubber which had failed electrically through direct burial in





Wire-flattening rolls

Extrusion and header die nibs

Mandrels and mandrel nibs

Nail gripper die nibs

This R-16 Carboloy cemented carbide die was in use at Wyckoff Steel Company for 26 months without requiring polishing or servicing. Over 5 tons of solid bar stock, in grades F.S. 1117 and F.S. 1118 (equivalent of C-1117 and C-1118) with 1/16" reduction, were drawn. All bars were push-started with a bench speed of 65-70 feet per minute. Carboloy die far outlasted other similar dies used previously.

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the ground. These failures were characterized by local regions of very low insulation resistance. The failures were not due to ordinary absorption of water and the physical properties of the rubber were normal. Drying the failed insulation raised the electrical resistance to an acceptable value, but a very brief exposure to moisture caused the megohms to disappear. Attack by soil microorganisms was suspected as the cause of these low resistance spots. We developed an accelerated laboratory test for microbial attack which showed that similar failures could be produced rapidly under conditions that excluded other causes. This accelerated test makes use of soil of high microbial content which is kept warm and moist. It must be emphasized that in service these microbiological failures are rare because the conditions are usually much less favorable for microbial activity.

★ ★ ★

Parallel tests in which replicate wire samples were buried in active soil and in sterilized soil and immersed in water have shown conclusively that the drastic loss of insulation resistance in active soil is due neither to water absorption nor to the effect of soil chemicals but is caused by the action of living microorganisms.

★ ★ ★

In the case of natural rubber some soil microorganisms can consume the hydrocarbon itself. This causes pitting of the rubber. Figure V shows a striking example of such attack. The hydrocarbon

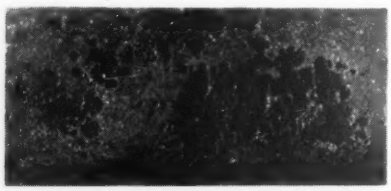

Figure V. Characteristic Pitting of Natural Rubber

of butyl rubber and GR-S apparently cannot be consumed by the microorganisms. None the less failures of insulations made from these rubbers can occur.

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In order to gain some insight into the mechanism of attack, failed rubber insulations were copper plated under controlled conditions. The regions of low insulation resistance showed deposits of copper which appeared on the surface as isolated specks. When the insulation was sectioned it was possible to find copper particles all the way through the wall. It was evident that in some way the microorganisms had created minute conducting paths completely through the insulation.

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Before the copper was electrodeposited it was not possible to see or to locate these conducting paths, or micropores. The ability of some organisms, notably bacteria, to consume natural rubber would lead one to expect it to fail eventually by erosion. Even with natural rubber, however, the action that creates micropores is so much more rapid that this is the predominant cause of failure in natural rubber as well as in the synthetics, butyl, GR-S and neoprene.

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The nature of the faults suggested that the microorganisms producing them actually pass through the wall when they cause electrical failure. To test this idea the conductor was removed from wire insulated with rubber compounds known to be vulnerable. The resulting tubes were filled with nutrient agar and sealed. They were then sterilized and exposed to soil various lengths of time. Then the surface was sterilized chemically, the tubes opened and the agar squeezed out on culture plates. Growth of fungus within a few days showed that the agar inside these tubes of vulnerable insulation had become infected by fungi. The only possible way for these to reach the interior of these tubes was by penetrating the insulation. This would undoubtedly cause electrical failures.

★ ★ ★

As a confirmatory test for presence of fungi inside the sealed tubes some of the agar was squeezed on glass slides and examined immediately under the microscope. In the agar from vulnerable samples abundant growth of fungus hyphae could be seen and photographed at a magnification of 100 times. (Figure VI)

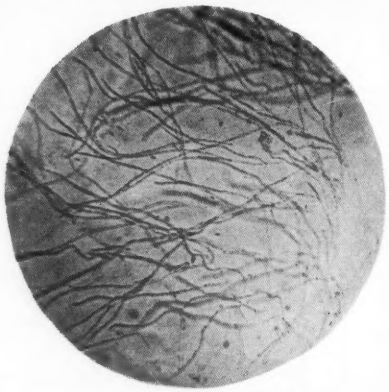

Figure VI. Photomicrograph of Fungus In Agar Squeezed From Tube of Vulnerable GR-S

This affords a quick test for the presence of fungi without waiting for cultures to be grown on plates. It also demonstrates clearly that the growth in the cultures cannot have been due to accidental contamination. In these experiments insulations resistant to microorganisms have not shown electrical failures and the corresponding agar filled tubes have not produced fungus growths on the culture plates.

★ ★ ★

All the evidence indicates that although certain bacteria may attack natural rubber hydrocarbon, it is fungi which are the principal cause of microbiological failure. It is perhaps reasonable to expect this. Bacteria have little mobility except in fluids and it is difficult to understand how they would have the power to force their way through a wall of insulation. The hyphae of fungi, which are the rapidly growing thread-like filaments, do have mobility through their growth. We know also they have quite high penetrating power, perhaps in a manner similar to that in which roots of a tree penetrate hard materials.

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The number of types of fungi that have been found capable of penetrating walls of rubber insulation appears to be very small indeed. Several of the ones isolated

(*Please turn to page* 201)

A Reply to a Criticism of the Increasing Load Wire Abrasion Tester

by H. T. McLean
Material and Processing Division
General Engineering Laboratory
General Electric Company
Schenectady, New York

In September, 1952, an article by Mr. McLean appeared in these columns. Dr. F. Levi, Chief Engineer of the Rola Company (Australia) Ptg. Ltd. in Victoria, took issue in our April, 1953, issue with the accuracy of method described of abrading the wire in a learned criticism. Mr. McLean, in his reply, justified his position on the basis of it being a practical, instead of a theoretical, appeared to the testing of magnet wire.

The criticism of my article on the Increasing Load Wire Abrasion Tester* by Dr. F. Levi in the April 1953 issue of "Wire and Wire Products" is most welcome, as it presents an opportunity to discuss the practical approach as distinguished from the theoretical approach to abrasion test of magnet wire.

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Speaking as one who helped develop the Repeated Scrape Abrasion Tester and who has been in fairly constant contact with the daily problems of abrasion testing for a number of years, I would like to take friendly exception to Dr. Levi's comments on the new tester.

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Dr. Levi has expressed doubt that the Increasing Load Tester is more accurate, and has defined accuracy in the following terms: "An abrasion tester will be considered more accurate than another one when the values of abrasion resistance measured by means of the first tester are more reliable indications of the abrasion resistance of the wire sample tested." This is an acceptable definition. Let us see how it works in practice.

★ ★ ★

It is a common experience to test two Formex wires with the Repeated Scrape Tester and get values similar to the following from 6 tests on each of 5 specimens of each wire:

Specimen	Scrapes to Failure Wire A Min.	Ave.	Max.	Spread Ratio	Scrapes to Failure Wire B Min.	Ave.	Max.	Spread Ratio
1	32	40	80	2.5	40	100	110	2.7
2	40	52	72	1.8	48	80	100	2.1
3	35	70	73	2.1	37	75	90	2.4
4	38	48	100	2.6	57	60	84	2.3
5	42	60	67	1.6	32	50	90	2.8
5-Specimen Ave.		54		2.1		73		2.5

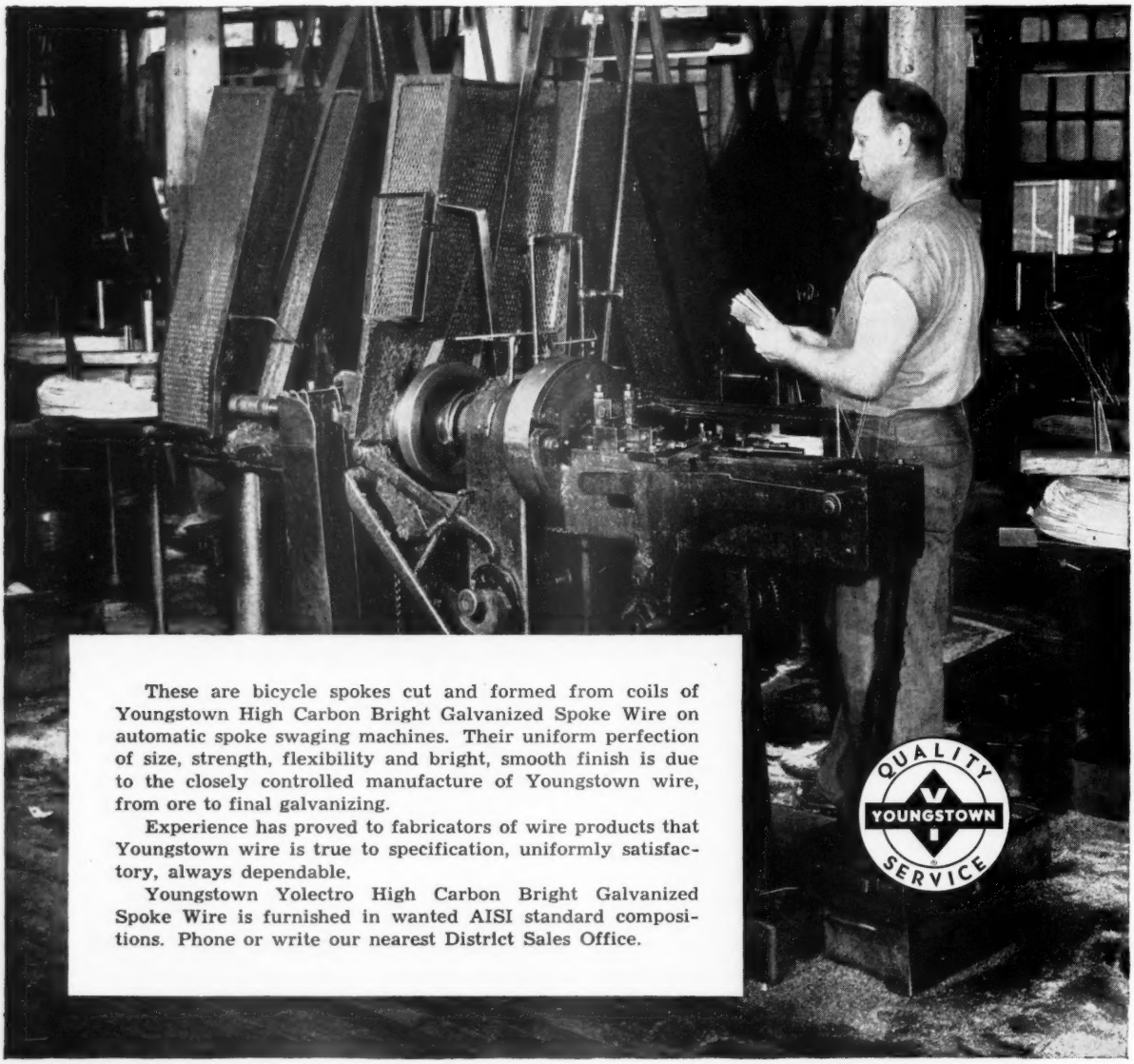
How much better is Wire B than A? The five-test average of B is higher, but for each pair of specimens the picture differs. For instance, compare specimens 1 and 5. Judging by average values, according to Specimen 1, B is 2.75 times as good as A; according to Specimen 5, B is only 83% as good as A. Such erratic results are common experience. Theoretically, they shouldn't occur. Actually, they do. And, note the overlapping ranges of A and B. Had we tested only a single pair of specimens, we would have had poor accuracy by Dr. Levi's definition; as it is, we still need statistical analysis to clarify the answer to how much better B is than A. Remember these are the results of 60 individual tests, representing over an hour's work, to which we must add

(*Please turn to page* 198)

Specimen	Failure Load-Gms. Wire A Min.	Ave.	Max.	Spread Ratio	Failure Load-Gms. Wire B Min.	Ave.	Max.	Spread Ratio
1	700	750	820	1.2	1000	1200	1300	1.3
2	710	750	850	1.2	1050	1100	1160	1.1
3	750	800	880	1.2	950	1000	1140	1.2
4	700	750	830	1.2	900	950	1040	1.1
5	700	760	850	1.2	860	900	950	1.1
5-Specimen Ave.		760		1.2		1120		1.2

* "The Increasing Load Wire Abrasion Tester"—H. T. McLean. Wire and Wire Products, September, 1952.

YOU GET BRIGHTER, MORE FLEXIBLE SPOKES WITH YOUNGSTOWN HIGH CARBON SPOKE WIRE



These are bicycle spokes cut and formed from coils of Youngstown High Carbon Bright Galvanized Spoke Wire on automatic spoke swaging machines. Their uniform perfection of size, strength, flexibility and bright, smooth finish is due to the closely controlled manufacture of Youngstown wire, from ore to final galvanizing.

Experience has proved to fabricators of wire products that Youngstown wire is true to specification, uniformly satisfactory, always dependable.

Youngstown Yolectro High Carbon Bright Galvanized Spoke Wire is furnished in wanted AISI standard compositions. Phone or write our nearest District Sales Office.

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Government Wire Production Information

GSA Contract to Develop Cuba's Nickel Resources

More nickel for American defense is assured, according to an announcement from the General Services Administration that it will go forward with an expansion of the Government-owned nickel plant at Nicaro, Cuba, and contribute financial assistance to promising research in new nickel metallurgy.

★ ★ ★

The new program was announced by Edmund F. Mansure, Administrator of General Services, upon notification that the Office of Defense Mobilization had certified that the Nicaro expansion and nickel research are "essential to national defense."

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Mr. Mansure also announced that the ODM certification has made available $43,000,000 to enlarge Nicaro's capacity by 75 per cent and has earmarked $1,000,000 as a research fund.

★ ★ ★

In its conception and design, the new program will lay a foundation for extending the production of nickel for an indefinite period of time. In this important respect, it differs from some earlier expansion programs which contracted for the delivery of definite quantities of nickel over varying terms of years.

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The size and scope, moreover, reflect the fact that nickel remains a vital commodity in short supply. The deal will aid in building our sources of production to the level at which supplies will equal the combined military, stockpile, and civilian requirements.

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Now in operation, the plant is currently producing nickel at a rate approaching 28 million pounds of nickel a year. The certified plan calls for an expansion of 75 per cent in capacity. Preliminary engineering studies have already been undertaken for the new structures and equipment which will be required to carry the development from planning to production.

Functions of Groups Advising GSA Outlined

The functions of business advisory and technical committees assisting the General Services Administration in the drafting of specifications and standards used in Government procurement operations were officially outlined in a regulation issued by **Edmund F. Mansure,** Administrator of General Services.

★ ★ ★

MICROMETER PRECISION — MICRO-WELD — TRADE MARK REGISTERED

MODELS J-3-C and J-4-C AUTOMATIC MICRO-WELD BUTT WELDERS

These welders are used for welding COPPER, ALUMINUM, and other non-ferrous wire ranging in size from .031" to .128" diameter.

The welding cycle on these welders is automatically controlled and completed by a single downward stroke of the foot pedal, which include the clamping of the wire being welded, contacting the welding switch, and applying the upset pressure on the weld. All units are equipped with annealing dies, filing vise, light, extension cord, and mounted on a 4-wheel truck.

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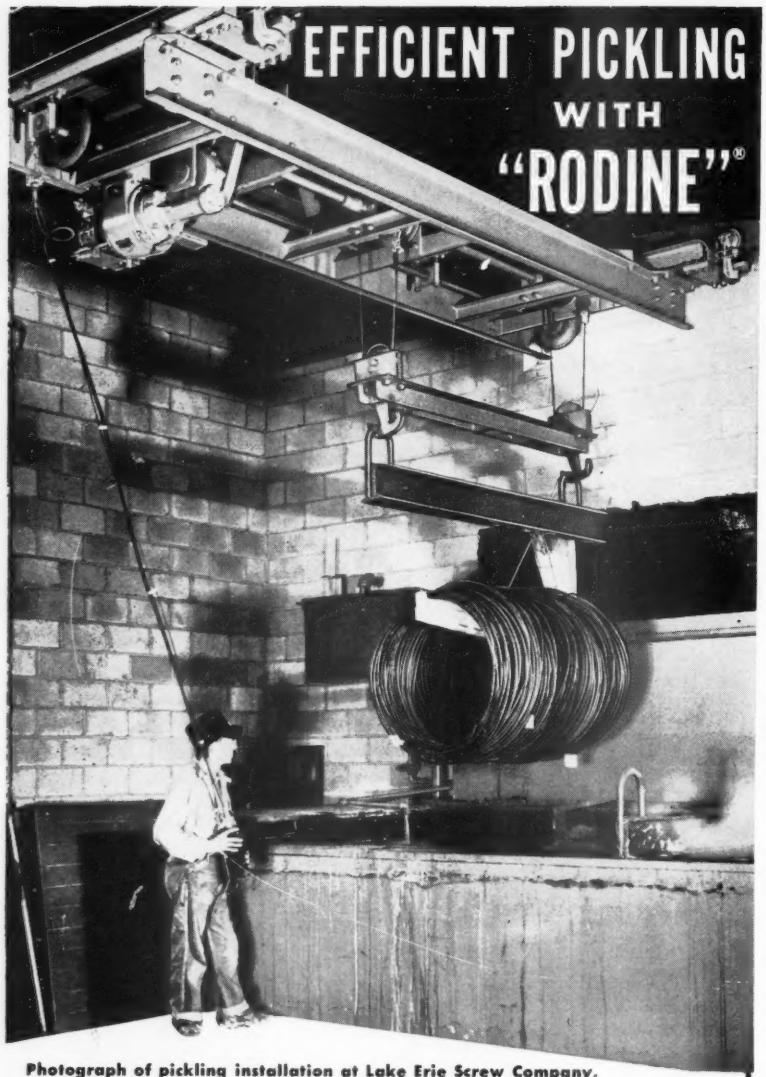

Photograph of pickling installation at Lake Erie Screw Company, by courtesy of The American Monorail Company, Cleveland, Ohio.

Rod and wire are pickled clean in "Rodine"-inhibited acid without waste of either acid or metal. Breakage in drawing, from acid brittleness, is minimized.

Wire and rod, pickled with "Rodine", as compared with less effective inhibition, are larger in diameter, and when drawn to the finished gauge the coils are longer and correspondingly heavier.

"Rodine" more than pays for itself in savings of acid and metal.

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Under certain conditions set out in the regulation, technical specialists from technical societies and trade associations may be invited to furnish the Government with their specialized knowledge and the benefit of their experience on specific projects related to Federal procurement matters.

★ ★ ★

The principal difference between business advisory committees and technical committees is that the latter do not examine policy matters but are concerned only with developing engineering and other technical data used in the writing of purchase specifications and standards.

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No salary is attached to service of either type of committee.

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Mr. Mansure indicated that the regulation had been issued following consultation with the Department of Justice which some time ago promulgated criteria for the guidance of Federal agencies utilizing industry advisory committees.

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Issuance of this regulation emphasizes the important benefits to be derived by the Government from obtaining advice on matters related to procurement operations from people and firms actively engaged in developing and producing articles of the types bought by the Government.

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Membership on GSA technical committees will be permitted only to fully qualified technicians whose experience and skill will benefit the Government. The GSA has in the past solicited information from such specialists, including representatives of technical societies and trade associations, and now feel that the granting of the privilege of direct participation in this kind of work, which so vitally affects both the Government and industry, is a long step forward.

ABSTRACTS

COPPER REFINING, ROLLING AND DRAWING
Brit Insulated Callender's Cables Ltd. Met Ind 1953 Vol 83 (16) pp 315-318 (Oct 16)
Description of Co.'s works at Prescot, Lancs. Aluminium wire drawn mainly for overhead conductor lines; main size range 0.080 to 0.160 in.; operation completed on one machine, using 7- to 9-die slip-type tandem machines. Copper wire drawn to 0.052 to 0.129 in. dia at 1,750 to 3,500 ft/min. Further drawing on medium heavy or medium fine machines, sizes from 0.005 to 0.020 in. on fine machines, some providing 0.001 in. dia. Drawing speeds at medium stage are 4,000 to 5,000 ft/min, up to 8,000 ft/min on one machine. Dies down to about 0.05 in. dia are tungsten carbide; diamond for smaller sizes; all made by Co. 4 illustr.

★ ★ ★

FINE TUNGSTEN AND MOLYBDENUM WIRE FOR ELECTRON TUBES. I
C. C. Gee (Mullard Ltd). Wire Ind 1953 Vol 20 (238) pp 977-978, 980-981 (Oct)
Surveys properties and applications of fine tungsten and molybdenum wire used in electron tube manufacture. Factory for wire and components recently established by Mullard Ltd has section for manufacture of extremely fine diamond dies for drawing finer wire. Wire considered fine before war ranged from 125 to 50 micron dia; fine tungsten wire now within 60 to 6 micron size range, molybdenum wire 200 to 25 micron. Increasingly finer wire likely to be required. Discusses origin and properties, manufacture and application, of tungsten and molybdenum. Wide variety of specifications obtained through different treatments. Slip mechanism discussed. (To be cont). 7 illustr, 3 ref, 1 table.

★ ★ ★

ELECTROLYTIC HEATING AS A MEANS OF INTENSIFICATION OF THE WIRE-DRAWING PROCESS
S. I. Gubkin, V. S. Muras. Doklady Akad Nauk 1953 Vol 91 (4) pp 803-806 (In Russian)
Electrolytic heating permits bright annealing to be carried out either on wire-drawing benches during drawing process or independently of it (this being a softening process obviating pickling or other oxide-removing operations). May be carried out in same installations whatever the conductor material drawn (in contra-distinction to induction or contact methods). Tried out on Cu, bronze, aluminum and steel wires. Bright annealing carried out in special type of electrolytic trough (heater), followed by shower-type cooler in which metal is cooled by electrolyte in absence of air. High-quality anneal requires adaption of speed of metal movement to supply voltage and dia of annealed metal. Relation takes form: speed $W = x\ V/D^2 - \beta/D^2$, where V=voltage, D=dia of metal, and coeff x and β depend on kind and temp of electrolyte, depth of surface layer and number of troughs constituting heater unit. Speed taken up to 75 m/min, but this is not the limit. Speed may be higher for higher degree of preliminary hardening. Softening of metal in electrolytic heater produces change of structure and mechanical characteristics, making metal

fact:
nothing in the world is as hard as a
diamond
FACT: in grinding carbides — nothing cuts as fast, as cool and as economically as a diamond wheel.
FACT: in drilling — diamond bits give lowest cost per foot in hard geological formations.
FACT: in dressing grinding wheels only diamond dressers will do the job where fine finish, high production or intricate forms are involved.
FACT: in wire drawing — diamond dies assure accurate sizing, bright finish and high output.
FACT: in lapping — diamond compounds and powders save countless skilled man-hours by producing wanted sizes and finishes faster.
FACT: in cutting — diamond cutting and boring tools are standard for tough jobs where the best of competitive materials fail.
FACT: in sawing — diamond saw blades feature speed and economy on quartz, concrete, stone, sapphire, glass and diamond.
FACT: Diamond Tooling gives you precise production, more production, uninterrupted production, lowest cost production.
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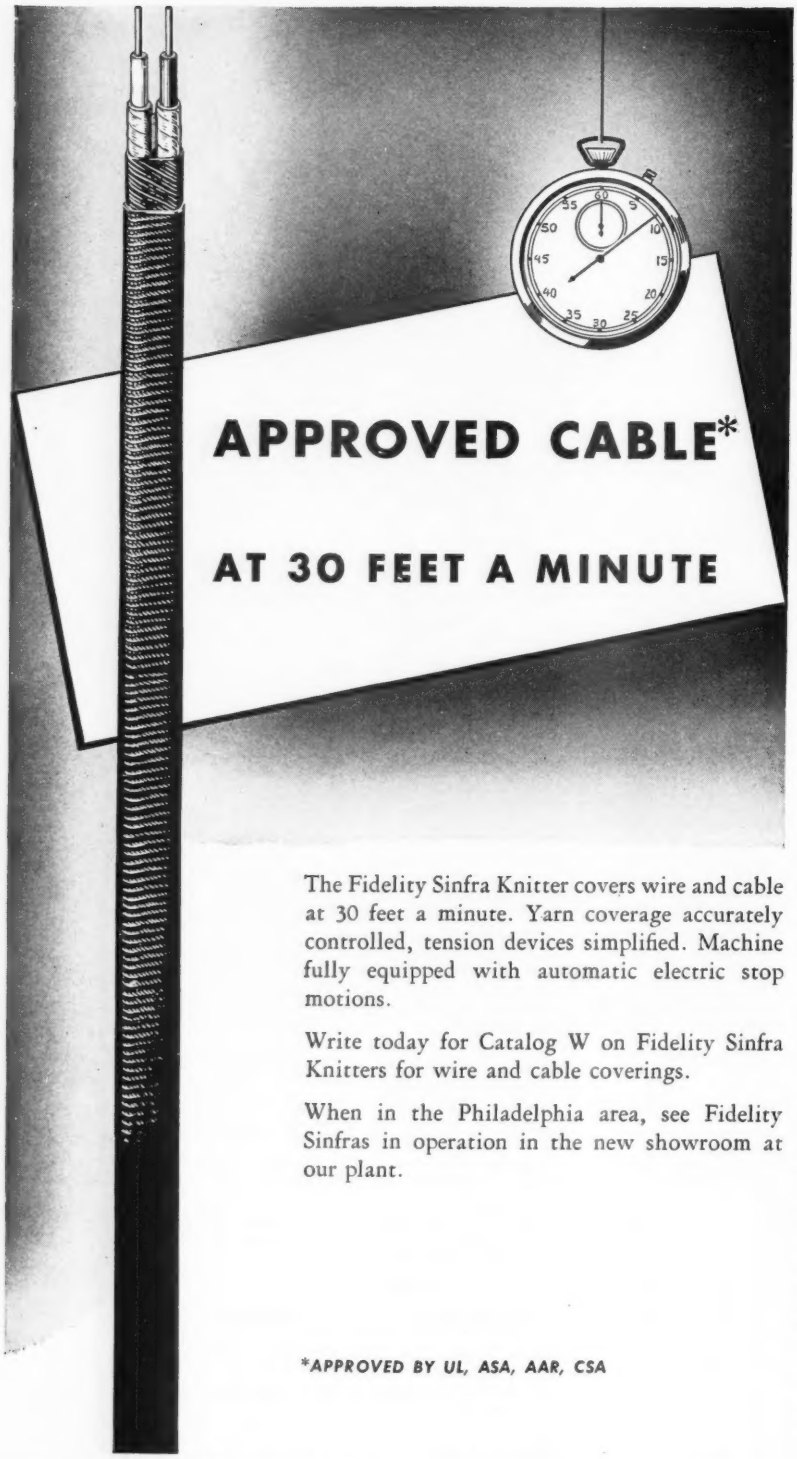

The Fidelity Sinfra Knitter covers wire and cable at 30 feet a minute. Yarn coverage accurately controlled, tension devices simplified. Machine fully equipped with automatic electric stop motions.

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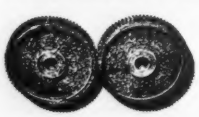

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more suitable for wire drawing.

★ ★ ★

PROCESSING OF PHOSPHOR BRONZE WIRE

E. W. Lovering (Seymour Mfg Co, Seymour, Conn). Wire & Wire Prod 1953 Vol 28 (10) pp 1039-1041 (Oct)

Properties of phosphor bronze alloys. Wire finishing over 0.072 in. dia drawn on heavy drawing machines, using tungsten carbide dies and soap lubricant. Wire finishing at dia under 0.072 in. drawn on 10 roll tandem mill to 0.165 in. sq, drawn dry to about 0.100 in. dia, then on multiple die wet wire drawing machines using water emulsion of fats and speeds up to 1,500 ft/min. Tungsten carbide dies used to about 0.040 in. dia; diamond dies below that size. 5 illustr.

★ ★ ★

A NICKEL-FREE AUSTENITIC STEEL FOR HIGH-STRENGTH WIRE

H. O. McIntire, G. K. Manning (Battelle Mem Inst). Wire & Wire Prod 1953 Vol 28 (10) pp 1019, 1023-1026 (Oct)

Account of efforts to replace chromium stainless steel wires for Army Signal Corps communication cable, corrosion resistance not being required in substitute material. This was developed from low-carbon chromium-manganese-iron alloys. Account of drawing and annealing. Die pull was determined at 0.057 in. die, using tungsten carbide die with 12 deg taper and Houghton's drawing lubricant No. 3105. Wire with satisfactory tensile strength and ductility, low electrical conductivity and no magnetism, made from Alloy 93, containing 0.06% carbon, 12.9% chromium, 16.2% manganese and 0.3% silicon. Amount of alloys similar to 304 stainless steel, manganese and copper being substituted for about 8% of chromium and 9% of nickel normally used. 4 illustr. 5 tables.

★ ★ ★

TUNGSTEN IN THE LAMP INDUSTRY

G. P. Moritz, W. E. Anderson. Westinghouse Eng 1953 Vol. 13 (3) pp 82-87 (May); Met Powder Rep 1953 Vol 8 (2) p 34 (Oct)

Production process from ore to coiled filament. Owing to very high mp, W must be obtained from ore by chemical purification followed by furnace reduction to metal powder, which, for use as filament material, is pressed to ingot form in a steel mould under 15 to 20 tons pressure, and given sufficient strength for handling by heating at 1,000 to 1,100 deg C for 1 hr in H. Desired crystal structure imparted by sintering, with current of 2,500 to 3,000 amp in H. Then follow operations of swaging, drawing, and coiling. Consideration of filament requirements for different lamp uses, and desirable improvements in filaments.

★ ★ ★

INDIA'S GOLD AND SILVER THREAD INDUSTRY

Anon. Wire Ind 1953 Vol 20 (238) pp 993, 995 (Oct)

Ancient drawing industry is still cottage industry; threads mainly used for silk saris, brocade, etc. Silver slabs melted and drawn into bars, heated and lengthened by beating on anvil, annealed and drawn through holes of steel plates. Wire drawing is by hand on 2 wheels,

with annealing for each drawing. In some workshops, locally made ruby dies used in later stages. Wire up to 27 G drawn. Fine wire, from 20 to 40 G, drawn through ruby dies, sometimes by experts using machines, flattened by passing through 2 rollers which press it into ribbon shape and wrapped over cottons or silk yarn. Various gilding processes. Progress retarded by old and crude machinery, defective annealing and surface oxidization spoiling appearance of wire and shortening die life. 5 illustr.

★ ★ ★

THE EFFECTS OF COLD DRAWING, MICROSTRUCTURE AND THERMAL TREATMENTS ON THE MACHINABILITY AND MECHANICAL PROPERTIES OF CARBON AND ALLOY STEEL
F. E. Dreves (Wyckoff Steel Co.) ASME Trans 1953 Vol 75 (7) pp 1219-1232 (Oct)
Paper to ASME spring mtg, Apr. 28-30, 1953. 37 illustr, 2 tables.

★ ★ ★

WIRE AND WIRE PRODUCTS
B. Dziarczykovski. Neuerscheinungen wiss Lit 1953 Vol 2 (8) p 423 (Apr) (In Polish)
Book, Gospodarcza, Warsaw, 1952, 206 pp, illustr. 2193.

★ ★ ★

ELOX HIGH-FREQUENCY ELECTRICAL DISCHARGE MACHINE FOR DIE-MAKING
Elox Corp of Am, Clawson, Mich. Am Machinist 1953 Vol 97 (21) p 215 (Oct 12)
Description of new M-400 model with new power supply and automatic feed arrangement. Use of hf current. Surface finishes of 50 to 80 micro-in. obtained. For special conditions, attachments available to produce finish of 10 micro-in. 1 illustr.

★ ★ ★

These abstracts are furnished by the Industrial Diamond Information Bureau, 34 Holborn Viaduct, London, E.C. 1, England, and are published through their courtesy. Inquiries regarding them should be directed to the Bureau.

1954 Marks "Diamond" Anniversary of Durant Manufacturing Company

From a back-yard stable shop on the West Side of Milwaukee, 75 years ago, grew the modern plant of the **Durant Manufacturing Company,** Milwaukee, Wisconsin, manufacturers of counting and measuring machines for industrial use. It is another of the American stories of business development under our free enterprise system.

★ ★ ★

The very first counter, designed by **W. N. Durant** in 1879, was a hand-made, flat case model with a trip lever extension for counting

If you are willing to work only on your own ideas, you limit yourself to the capacity of one man.

Here at Johnson we have long been proud of our team. Without teamwork we could not produce the customer-satisfying volume of specialty wires. Our team is spread throughout the plant and in the laboratory, all over the plant where expert inspectors follow through each order to the shipping department where wire is wrapped with care and securely packed for shipment. Here, individual effort is compounded in the team.

JOHNSON STEEL AND WIRE COMPANY, INC.
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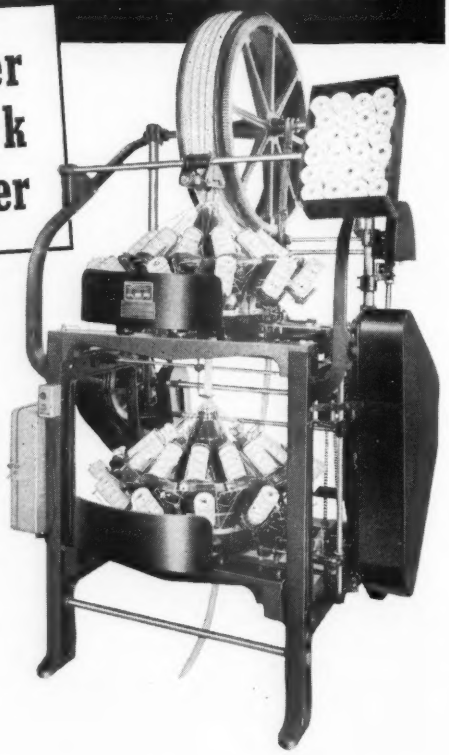
A SUBSIDIARY OF PITTSBURGH STEEL COMPANY

THE NEW "WARDWELLIAN"®

24-24 Carrier Double Deck Cable Braider



This machine has all the features of the WARDWELLIAN Cable Braider, plus the added feature of applying two layers of braid simultaneously. Each head can be adjusted individually to give the desired number of picks or plaits for each layer of braid.

Machine is driven by a three horsepower adjustable speed motor that gives great flexibility of operation through the dial control. Power is transmitted from motor to braider through the medium of a Maxitorq Floating Disc Clutch mounted on the countershaft.

- Production 44" to 340" per minute depending upon the texture of the product.
- Standard set of eighteen change gears for varying takeup furnished with each machine.
- Standard set of ten change gears for varying speed of lower head furnished with each machine.
- Carrier speed 75 R.P.M. for cables ¾" diameter to the maximum of 1⅛" diameter or 500,000 circular mils; production 900 picks or plaits per minute.
- Carrier speed 100 R.P.M. for cables ¾" diameter and under, 1200 picks or plaits per minute.
- Speed of braider countershaft 345 R.P.M. for carrier speed of 75 R.P.M. or 460 R.P.M. of countershaft for carrier speed of 100 R.P.M.
- Ratio braider countershaft speed to carrier speed 4.6 to 1.
- Carrier speeds can be varied from a maximum of 100 R.P.M. to a minimum of 33 R.P.M.
- Capstan 36" diameter, 6" face.
- Beater openings in both upper and lower heads 1¾" diameter.
- Supply yarn packages Universal wound, 2 1/16" dia., 5" traverse, on tube 5¼" long, ⅝" hole, four point wind.
- Supply and windup stands not furnished.
- Machine can be adapted for producing one-and-one braid by changing thread deflectors.
- Counter for measuring in feet or yards furnished upon request.
- Weight approximately 2500 lbs.

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Wardwell
BRAIDING MACHINE CO.
CENTRAL FALLS, RHODE ISLAND, U.S.A.

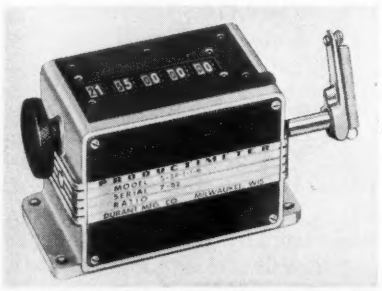
bags of flour in rolling mills. During the following 25 years, the Durant business grew with the development of counters for the metal-working field. In the early 90's Durant offered one of the first electric counting machines.

★ ★ ★

Model 5-A Stroke Tally. Designed and manufactured by W. N. Durant, 1879 for tallying sacks of grain in flour mills. * * * * *

Definite expansion took place some 26 years later, when the Durant Manufacturing Company was purchased by **H. O. Winkler.** The years 1905 to 1920 were important years in the Company's growth. The plant was moved to larger quarters, and model designs were completely changed from the flat case, with individual reset knobs for each figure, to the odometer or number wheel type counter in which all figures are reset in one motion. This new counter design was as important a step as the original concept of the mechanical counter. From it grew the many and varied mechanical and electrical counters that now supply every industrial production need, including the electronic and instrument field, with accurate reliable count records.

★ ★ ★



Model 5-SP-1-1-R Predetermined Counter. Latest of Durant Counter designs. Compact, streamlined, finished in brown and silver. The predetermined wheels can be pre-set for a desired quantity run. * * * * * * * * *

A new one-story plant was built in 1914 at the present location, 1929 N. Buffum Street. The steady growth of the company after the

first World War made it necessary, in 1928, to expand this plant to three stories. Warehousing and office space of 15,000 square feet was purchased in 1948. A new addition completed early in 1952 added another 16,000 square feet to provide space for new offices and plant production.

★ ★ ★

Under the management **of William K. Winkler,** who has been with the Company since 1909, and its President from 1920 to 1952, the Durant Manufacturing Company attained a position as the country's second largest manufacturer of counting instruments. In 1953 Mr. Winkler became Chairman of the Board; **William W. Winkler,** with Durant since 1940, became President; and **Robert B. Winkler,** joining the Company in 1945 after service in World War II, became Vice-President. **Leo A. Nourie,** Eastern Division Manager for over 25 years, is Secretary.

★ ★ ★

The Company maintains offices in Providence, Boston, Detroit, Chicago and in Greenville, S. C., and has representatives in all principal cities in the United States, Canada, Mexico, South America, and other foreign countries.

Second Symposium on Wire and Cable Held by Signal Corps

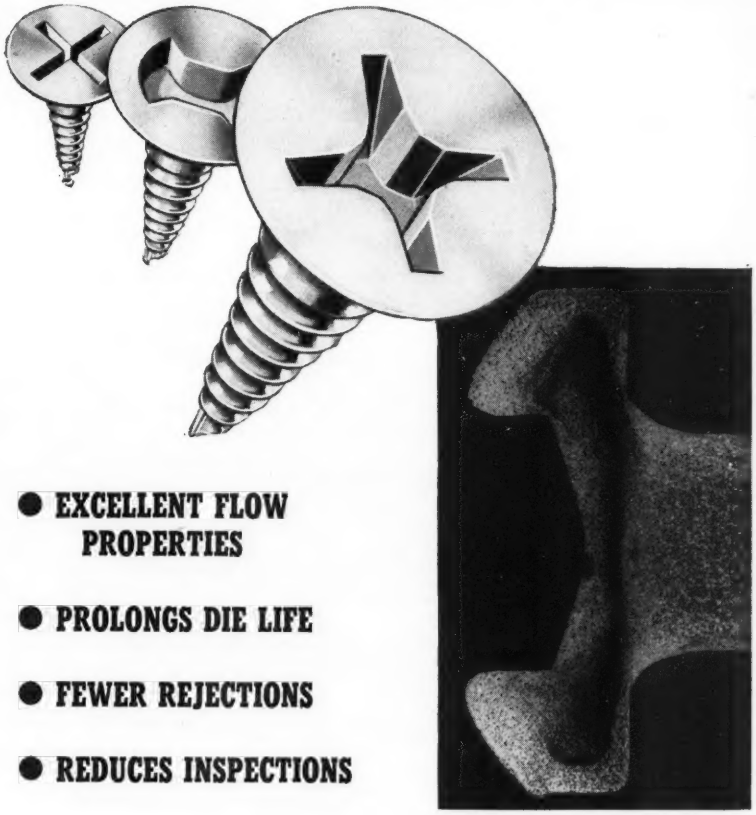
In response to the wishes of the majority of those who attended the 1952 session, the Wire Communication Branch, Coles Signal Laboratory, Signal Corps Engineering Laboratories, Fort Monmouth, New Jersey, sponsored the Second Annual Symposium on "Technical Progress in Communication Wires and Cables" on December 14, 15 and 16, 1953, at Asbury Park, N. J.

★ ★ ★

The meeting was well attended, somewhere in the neighborhood of 450 persons being present for the sessions. It is estimated that about 350 of these were identified with wire and cable manufacturers, the balance being individuals connected with the Signal Corps and supplier concerns.

★ ★ ★

KEYSTONE "SPECIAL PROCESSED" COLD HEADING WIRE



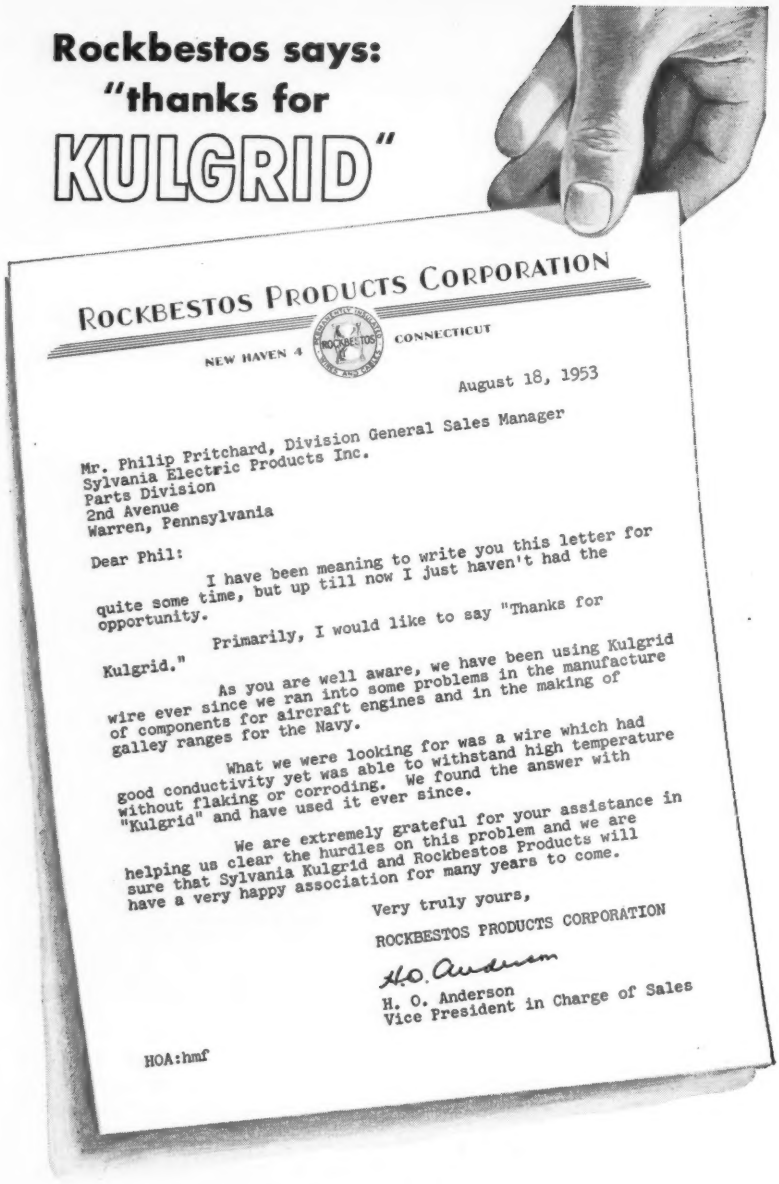
- EXCELLENT FLOW PROPERTIES
- PROLONGS DIE LIFE
- FEWER REJECTIONS
- REDUCES INSPECTIONS

The excellent grain flow properties of this superior cold heading wire assures the desired upsetting and die forming qualities you need for greater efficiency in the production of Phillips head, clutch head and cross-recessed head screws.

The structural soundness and uniformity of Keystone "Special Processed" Cold Heading Wire is attained by careful selection of raw materials, our own exclusive drawing and heat treating process, rigid quality controls and inspections. Compare the performance of Keystone "Special Processed" Cold Heading Wire next time you have a difficult cold heading problem to solve.

Keystone Steel & Wire Company
PEORIA 7, ILLINOIS

Rockbestos says: "thanks for KULGRID"



ROCKBESTOS PRODUCTS CORPORATION

NEW HAVEN 4 CONNECTICUT

August 18, 1953

Mr. Philip Pritchard, Division General Sales Manager
Sylvania Electric Products Inc.
Parts Division
2nd Avenue
Warren, Pennsylvania

Dear Phil:

I have been meaning to write you this letter for quite some time, but up till now I just haven't had the opportunity.

Primarily, I would like to say "Thanks for Kulgrid."

As you are well aware, we have been using Kulgrid wire ever since we ran into some problems in the manufacture of components for aircraft engines and in the making of galley ranges for the Navy.

What we were looking for was a wire which had good conductivity yet was able to withstand high temperature without flaking or corroding. We found the answer with "Kulgrid" and have used it ever since.

We are extremely grateful for your assistance in helping us clear the hurdles on this problem and we are sure that Sylvania Kulgrid and Rockbestos Products will have a very happy association for many years to come.

Very truly yours,

ROCKBESTOS PRODUCTS CORPORATION

H. O. Anderson

H. O. Anderson
Vice President in Charge of Sales

HOA:hmf

Rockbestos Products Corporation is another important modern manufacturer that appreciates the fine performance and durability of KULGRID . . . Sylvania's nickel-clad copper wire.

Kulgrid's tough nickel coating resists corrosion and guards the copper core from deterioration, while assuring excellent electrical conductivity. You'll find Kulgrid ideal for high-temperature wiring in electric furnaces, stoves, industrial ovens, and many aircraft applications. Available in single or stranded forms. New illustrated booklet gives full details. For your file copy, address: Sylvania Electric Products Inc., Dept. 4A-4802 1740 Broadway, New York 19, N. Y.

SYLVANIA

LIGHTING • RADIO • ELECTRONICS • TELEVISION

In Canada: Sylvania Electric (Canada) Ltd., University Tower Bldg., St. Catherine St., Montreal, P. Q.

The meeting was opened on Monday afternoon by Colonel F. F. Uhrhane, who made the welcoming address. Mr. H. L. Kitts, Chief of the Outside Plant Equipment Section of the Coles Signal Laboratory, served as general chairman, with other prominent staff members acting as chairmen of the several sessions during the three day program.

★ ★ ★

From 5:30 to 7:00 P. M. on Monday some thirty-three companies represented there played host to the persons in attendance in a pleasing cocktail party, at which an orchestra supplied background music for the occasion.

★ ★ ★

On Tuesday, after a busy day, during which some twelve papers were presented, a banquet was held in the evening, at which an unusually fine address was made by the principal speaker of the evening, Brigadier General W. T. Guest, Commandant of the Signal School at Fort Monmouth. He discussed in a most entertaining way some of the human interest aspects of his experiences in Korea. The toastmaster of the evening was Milton Lipton of the Signal Corps.

★ ★ ★

At the speaker's table, besides the General and Mr. Lipton, were those industry and Signal Corps personnel who had served on the committee that arranged the details of this very successful symposium.

★ ★ ★

Some of the more pertinent papers we shall hope to publish here, as the opportunity offers, to provide those in the industry who were unable to attend with the excellent information presented. Discussions followed each paper, but as these were not recorded, they cannot be published.

America's Oldest Brass Firm Pioneer in Aluminum Field

Scovill Manufacturing Company, Waterbury, Conn., America's oldest brass firm, has just issued a new 20-page booklet covering the company's 64 years' work in alu-

minum since 1889. This booklet was initially distributed at the National Metal Exposition in Cleveland.

★ ★ ★

The booklet announces the results of the latest research efforts by Scovill, stating that it has "a new industry standard in controlled quality and uniformity" in its cold-rolled aluminum strip. This is achieved by exceptionally close control of inherent physical and mechanical properties of the metal, making it possible to minimize "orange peel" and "earing" effects.

★ ★ ★

These two defects have dogged fabricators of the metal, since such have made necessary additional finishing operations to remove imperfections caused by metal characteristics inherent in grain structure and size, temper, tolerances, and finish.

★ ★ ★

Scovill has put into operation a new cold-rolling mill which uniformly produces aluminum coils weighing up to 2,000 pounds each, also giving fabricators the advantage of greater economy for very long runs.

★ ★ ★

The brass firm first started negotiations with the Pittsburgh Reduction Company, predecessor of the **Aluminum Company of America,** shortly after **Charles M. Hall** received his process patent covering the reduction of aluminum by electrolysis. Early inter-company correspondence shows that on July 9, 1889, the Pittsburgh Reduction Company agreed to furnish aluminum ingots to Scovill on the basis that the next six months "be devoted to testing possibilities of making a market for aluminum and aluminum alloys."

★ ★ ★

A special section of the booklet contains technical data on five basic alloys offered currently by Scovill, including fabricating characteristics, standard temper designations, relationships between diameters, weights, lengths and thicknesses of coils, gauge comparisons, and conversion factors and definitions.

The REEL News is that STEEL Costs Less!

Steel is **DURABLE**
Tests now being conducted indicate a life of 12 times that of wooden reels. Minimum maintenance.

Steel **COSTS LESS**
Although its cost initially is about 30% higher, its longer life results in at least a 400% saving.

Steel **PROTECTS**
The cost of a reel is infinitesimal compared to the value of cable it carries. Drop it, bounce it, handle it roughly. Steel stands up and protects your investment.

Steel is **RUGGED**
Steel reels do not warp, bulk less, carry more payload. Precision made, weatherproof, balanced.

NYECO REELS

SHIPPING REELS *(I-Beam or Channel)*
PROCESSING REELS *Heavy-Duty*
DRUMS and FLANGES *available separately*

Over 45 years of service in metal fabrications

NYECO

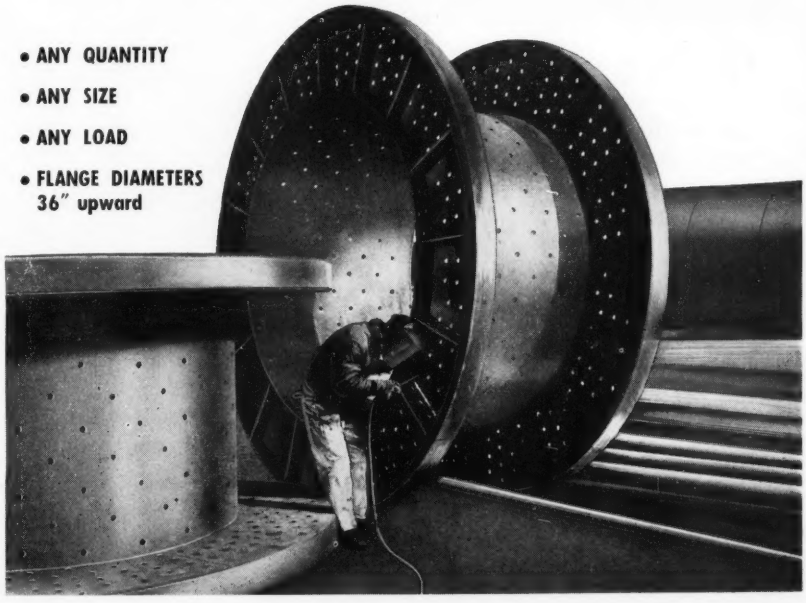
- Reels
- Tanks
- Vulcanizers
- Stands
- Caterpiller Take-Ups
- Cabling Machines
- Floor rolls
- Annealing Retort Hoods and Bases

YOUR INQUIRIES INVITED

NYECO is now furnishing Steel Reels to America's leading mills, including Phelps Dodge, Anaconda, General Cable, Roebling, Western Electric, Okonite. Without obligation, inquire for quotations on your specifications. Large plant, automatic production facilities, flexible set-up, with motor, rail, and water shipping facilities at the premises, insure accurate work, prompt deliveries, competitive prices, on large or small orders.

NEW YORK ENGINEERING COMPANY
75 West Street, New York 6, N.Y.
Telephone: WHitehall 4-5380
PLANTS: Yonkers, N. Y.

- **ANY QUANTITY**
- **ANY SIZE**
- **ANY LOAD**
- **FLANGE DIAMETERS 36" upward**



Outstanding Personalities of the Wire Industry

Ernie Clark Retires

Ernest W. Clark, one of the few real authorities on copper wire and electric wire and cable, retired from active work on December 31, 1953.

★ ★ ★

He was born on November 9, 1880 and became associated with the General Electric Company in February, 1907, as Assistant Superintendent of the Wire and Cable Department. Shortly thereafter he was made Superintendent, a position he held until his retirement at the end of 1944. He became a Consulting Engineer, devoting most of his time to the Syncro Machine Company in Perth Amboy, N. J.

★ ★ ★

Due to his mechanical ability, good judgment and creative imagination many of the features of design in wire drawing and cable manufacturing equipment in use today may be attributed to him.

★ ★ ★

He has always been an active member of the Wire Association and for many years served as a director of it. He served on many committees, one concerning the standardization of reels, being particularly fruitful of excellent results for the industry.

ERNEST W. CLARK

★ ★ ★

One of his outstanding characteristics is his ability to get along with others. A former G. E. associate states that he was highly respected by machine operators, by his superiors and by everyone with whom he came in contact, adding: "I can personally say that he was not only an authority on wire manufacturing processes, but a "swell guy" as well."

★ ★ ★

The best of wishes of all of us are with you, Ernie.

Sales Executive Promoted and Moved to Home Office

Norman P. Norlie, formerly Western Manager for the **Wilbur B. Driver Company,** has been made Sales Manager of the company and moved to headquarters at 1875 McCarter Highway, Newark 4, N. J.

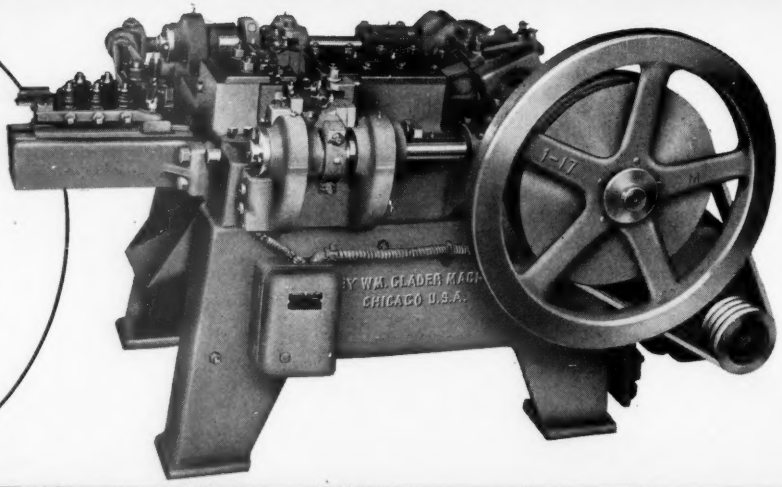
GLADER

HIGH SPEED WIRE NAIL MACHINES

HIGH TONNAGE OUTPUT—LOW MAINTENANCE COST

You can take care of increased production schedules and better product demands with these machines of established reputation.

For 55 years GLADER MACHINES have been giving HIGH QUALITY, LOW COST nail production.



Wm. Glader Machine Works 210 N. Racine Avenue Chicago 7, Illinois

Export Dept.: 122 E. 42nd Street, New York 17, N. Y.

Named Works Manager, Ansonia Branch, American Brass

Newman V. Gates formerly production supervisor of the Ansonia branch of the **American Brass Company,** has been selected for the position of works manager, it has been disclosed here by **Arthur W. Wilkinson,** vice president. He succeeds the late **Irving H. Hofmann.**

★ ★ ★

Mr. Gates was educated in the public schools of Milford and attended Lehigh University and Massachusetts Institute of Technology. He is 41 years of age.

★ ★ ★

In 1935 he entered the service of the American Brass Company. He was assigned to the methods and standards department in 1937. In 1942 he was appointed chief methods and standards engineer for all divisions of the company and in 1950 he was appointed production supervisor for the Ansonia branch. In the latter capacity he played a prominent part in the recent rehabilitation of the wire and cable department and the brass rod and extrusion shape departments.

Copperweld Promotes Whitney and Zinsser

The Wire and Cable Division of **Copperweld Steel Company,** Glassport, Pa., has announced the promotion of **Leslie Clifton Whitney** to Manager of Development Engineering. Mr. Whitney has been serving Copperweld since 1930 as Chief Metallurgist. His new duties at Copperweld include process and product development, as well as quality control.

LESLIE CLIFTON WHITNEY

★ ★ ★

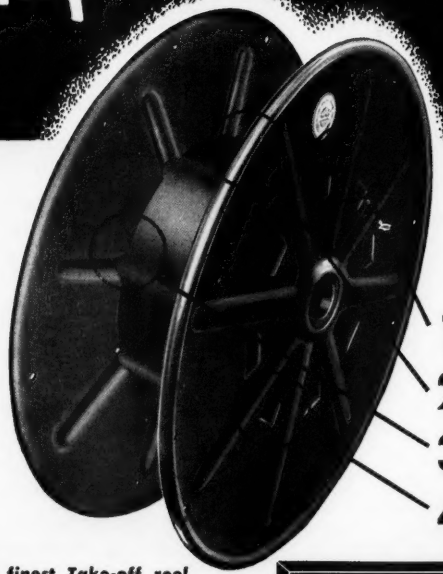
Mr. Whitney is a graduate of Lehigh University from which he holdes a degree in Metallurgical Engineering. He is Vice President, Ferrous Division, of **The Wire Association** and a past chairman of the Pittsburgh Chapter of the American Society for Metals.

★ ★ ★

At the same time it was announced that **Harry F. Zinsser** had been appointed Chief Metallurgist filling the vacancy left by Mr. Whitney's promotion. Mr. Zinsser joined Copperweld twenty years ago and has been Assistant Chief Metallurgist since 1946. During World War II, he was a Lieutenant Colonel in the U. S. Army Engineer Corps. He received his degree in Metallurgical Engineering from Carnegie Tech.

Important DIFFERENCES

BETWEEN JUST ANY REEL AND All Welded MPS



TAKE-OFF REELS

Three important differences that mean longer reel life in both processing and handling of all types of insulated wires in your plant.

1 **New** MPS **deep wide, straight type embossed radial rib** adds considerable strength to reel heads over the old style narrow tapered rib.

2 **Increased height of the curled edge** adds even more strength and rigidity, especially to the rims.

3 Furnished with **rib fillers** that are projections on the end of the barrels that fit into the embossed radial ribs thereby **eliminating any marking of the plastic or rubber insulated wires** at the junction of head-barrel.

4 Finally, the **all welded "J" type construction** of the entire reel completes the picture.

The finest Take-off reel you can buy.
We invite your inquiries — let us tell you more about MPS Take-off Reels. Write us today.

Mossberg PRESSED STEEL Corporation

18 West Street — Attleboro
Massachusetts U. S. A.
***Telephone* Attleboro 1-0848**

#109

AS&W Has New Detroit District Manager

Appointment of **Edward A. Murray** as Detroit district manager of sales for **American Steel & Wire Division** was announced recently by **John Graham,** general manager of sales for this United States Steel unit.

★ ★ ★

The appointment marks Murray's return to American Steel & Wire, which he previously served in various sales executive capacities. For two years he has been vice president—sales of the Appleton Electric Company, Chicago.

★ ★ ★

In his new post he succeeds **Maxwell D. Millard,** who recently was named assistant general manager of sales for American Steel & Wire at headquarters in Cleveland.

Elgin's Spring Alloy Again Available

Elgiloy, the cobalt-base spring alloy developed by **Elgin National Watch Company,** Elgin Ill., has been placed back on the commercial market, it has been announced by **Thomas R. Green,** technical director of Elgiloy for the company's abrasives division. The alloy had been removed from the market in 1950 because of government restrictions on use of cobalt and nickel.

★ ★ ★

Principally composed of cobalt (40%), chromium (20%) and nickel (15%), Elgiloy is noted for high hardness, toughness, tensile strength, corrosion resistance, set and fatigue resistance, and its being non-magnetic.

★ ★ ★

Besides watch springs, Elgiloy has found use in toaster pop-up mechanisms, flapper valves, surgical and dental equipment, drawing instruments, camera parts, wrist watch bands and snap switch components as well as in countless forms as springs. It also has been made into balls for ball bearings used in scientific and industrial control instruments because of its high shock resistance and the high surface finish obtainable.

★ ★ ★

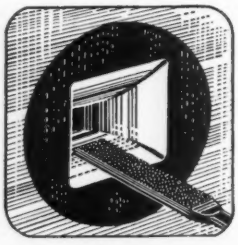
Elgiloy is obtainable from Elgin for industrial use in three forms. The company will supply it to manufacturers either in the form of raw stock, heat-treated, or completely fabricated into Elgiloy parts made to the manufacturer's specifications.

New Address for Mettler's New York Office

William L. DeSenti, President of **Mettler Machine Tool, Inc.,** New Haven, Conn., has announced that as of January 1, 1954 their New York sales office became known as Mettler Machine Tool, Inc., 11 Broadway, New York 4, New York.

★ ★ ★

Mr. S. Straus, President of Artys Sales Co., shall conduct and manage the ever increasing sales promotion of Mettler's Shuster Automatic Wire Straightening and Cut-Off Machines.

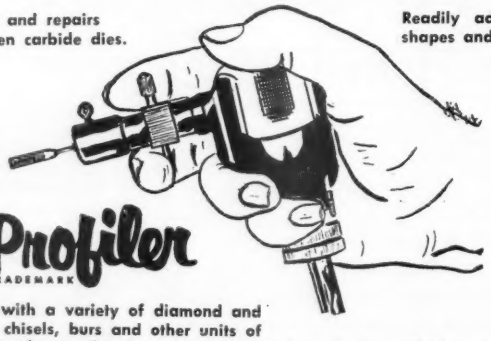


90% of TIME SAVED

that would normally be used to make a die maker's special files, chisels, scrapers, etc.

Makes and repairs tungsten carbide dies.

Readily adapts to special shapes and contours.



SHARPENS
GRINDS
FILES
SCRAPES
HONES
LAPS
SAWS
STONES
CUTS
FINISHES
POLISHES

the *Di-Profiler TRADEMARK

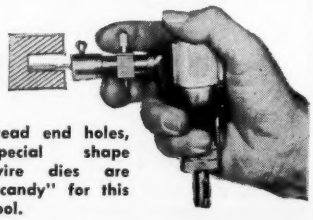
is furnished with a variety of diamond and needle files, chisels, burs and other units of many intricate shapes, thereby reducing the tool and die maker's problem of special tools (made on your time) by 90%.

The *Di-Profiler can be used for repairing dies, even without removing from machine. You can hold your files absolutely level for straight holes and provide an oscillating motion for contour. The reciprocating action does the work at a stroke ranging from 0" to ¼", without vibration because of the high precision of the tool. Once you see it—you'll never do without the *Di-Profiler. Write for full details and ask for a demonstration only by Orange, N. J., factory trained representatives.

SAVE YOUR TOOL MAKERS AND MAINTENANCE MEN BY PROVIDING TOOLS TO DO THE HARD, TIRING PART OF THEIR WORK.

*DI-PROFILER ELIMINATES THE HARD "ELBOW GREASE" WORK.

Everything comes in an attractive mahogany finished box — except the flexible shaft, rotary attachment and motor.



Dead end holes, special shape wire dies are "candy" for this tool.

Nord International Corp.

449-W CENTRAL AVENUE, ORANGE, NEW JERSEY

* As exclusive Nord Trade Mark

GE Appoints Electrical Industry Sales Manager

J. Scott Hurley, Jr. has been named supervisor-electrical industry sales, in the marketing section of the **General Electric Company's** silicone products department, according to an announcement at department headquarters recently.

★ ★ ★

Mr. Hurley will be located at department headquarters at Waterford, N. Y. In his newly-created post, he will be responsible for sales development activities related to the use of silicone products by the electrical industry.

★ ★ ★

Making the announcement, department general manager **Dr. C. E. Reed** said that "the increasing number of silicone applications in the electrical industry warranted special marketing attention to this growing field."

★ ★ ★

A native of Seaford, Delaware, Mr. Hurley joined General Electric in 1937 as a chemical engineer. In 1945 he was transferred to the Chemical Division as a silicone sales engineer.

★ ★ ★

On Jan. 19, 1953, he was appointed supervisor of technical service for the Silicone products department's engineering section, the post which preceded his present appointment. He is a graduate of Drexel Institute of Technology.

Zur Joins Shomer in Cleveland

John F. Zur, a metallurgical engineer associated with the **Trauwood Engineering Company,** and for the past two years with the **Lee Wilson Contracting Company,** has joined the staff of the **J. A. Shomer Co.,** Cleveland, Ohio, distributors of industrial machinery and products. The company will shortly offer a line of heavy duty electric heating units, both immersion and open types.

★ ★ ★

Mr. Zur has delivered papers at Wire Association conventions and on several occasions written technical articles for WIRE AND WIRE PRODUCTS.

Carboloy Takes on Training Instructor

Carl A. Moeller, former supervisory training instructor in the Detroit Ordnance District, has joined **Carboloy Department of General Electric Company** in Detroit as an instructor in the customer training school.

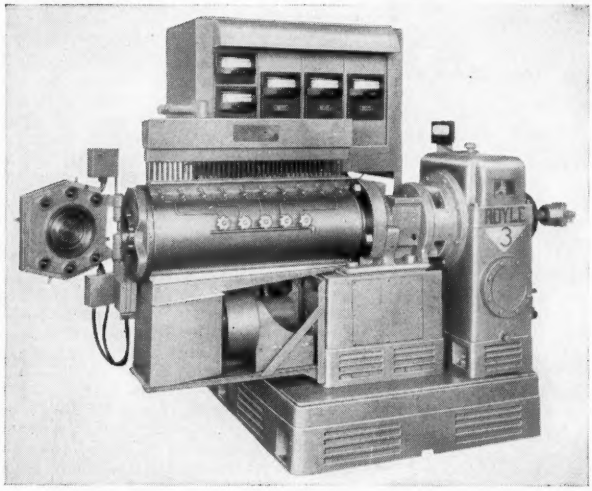
★ ★ ★

Mr. Moeller taught industrial arts both in Saginaw, Mich., schools during 1942-46, and at Texas A. & M. from 1950 to 1952. He holds a B.A. degree in art and education from Michigan State College, and M.E. in industrial education from Texas A. & M.

★ ★ ★

He replaces Lloyd Mattson who transferred recently to Carboloy's Edmore permanent magnet plant.

FASTEST HEATING FASTEST COOLING



Here are some of the time-tested, money-saving reasons more and more plants are standardizing with Royle Spirod* Extruders for processes requiring maximum flexibility in controlled temperatures — constantly maintained and accurately zoned:

- **Extra heavy walled cast steel cylinders that will not warp. No joints to leak when pressures are high or crevices to collect burned compound that would cause contamination.**
- **Heavy duty large diameter heating elements, that can be used with 440 volts without step-down transformers, provide radiant heat to cylinders and heads.**
- **Any heating element may be removed and replaced without disturbing other elements or wiring.**
- **A cooling system with ten times the capacity of conventional designs can be modulated through its entire temperature range without drastic changes. Ample cooling for all compounds at maximum speeds.**

No. 3 Royle Spirod Extruder. Completely insulated and equipped for evaporative cooling.

*Patent Applied For

JOHN ROYLE & SONS

ROYLE PATERSON N. J. 1880

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

London, England — James Day (Machinery) Ltd. — REgent 2430
Home Office — V. M. Hovey J. W. VanRiper — SHerwood 2-8262
Akron, Ohio — J. C. Clinefelter — SWandale 4-5020
Los Angeles, Cal. — H. M. Royal, Inc. — LOgan 3261

PATERSON 3, NEW JERSEY

A Review of Recent Wire Patents

No. 2,660,748, WINDSHIELD WIPER TENSIONING ATTACHMENT, patented December 1, 1953 by Rolland V. Gaumer, Zanesville, Ohio, assignor to Industrial Devices of America, Inc., Zanesville, Ohio, a corporation of Ohio.

The attachment is constructed of a single length of resilient wire.

★ ★ ★

No. 2,660,771, CORSAGE SUPPORT, patented December 1, 1953 by Dominic A. Zarlengo, Denver, Colo.

This support comprises a length of suitable wire bent to shape.

★ ★ ★

No. 2,660,772, HOLDER FOR FABRIC, NAMELY DIAPERS, patented December 1, 1953 by Earl V. Ehrhardt, Altadena, Calif.

A holder is provided comprising a unitary length of wire.

★ ★ ★

No. 2,661,029, METHOD OF MAKING A FINE WIRE MESH, patented December 1, 1953 by Edward J. Walsh, Tenafly, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York.

The method comprises winding a series of coplanar turns of fine wire on a gold-plated supporting member, winding a second coplanar series of turns of fine wire on this support transverse and in contact with the first series of turns, placing the support member and the windings in a non-oxidizing atmosphere, subjecting them to a temperature sufficient to fuse the gold and permit it to flow along and coat the windings, and cooling the windings whereby the coating of one winding adheres to the coating of the other winding bonding the intersecting wires together.

★ ★ ★

No. 2,661,163, AUTOMATIC WIND AND REWIND SYSTEM FOR STRIP MATERIALS, patented December 1, 1953 by Percy E. Greene, Denville, N. J., assignor to Leventhal Patents, Inc., New York, N. Y., a corporation of Delaware.

There are ten claims to this patent. A machine for winding variable length elongated strips back-and-forth from one roll to another.

★ ★ ★

No. 2,661,568, BOOKHOLDER, patented December 8, 1953 by Nathan I. Stark, West Orange, N. J.; Dorothy Stark, administratrix of said Nathan I. Stark, deceased.

A single length of stout wire provides the holder.

★ ★ ★

No. 2,661,921, GARBAGE CAN SUPPORT, patented December 8, 1953 by Sam Brustein, Akron, Ohio.

This device is constructed of stiff wire.

★ ★ ★

No. 2,662,257, FISH STRINGER, patented December 15, 1953 by Horace Robert Milan and Oswald L. Bluege, Washington, D. C.

More specifically this is a holder unit to be secured with similar units to the spreader of a fish stringer.

★ ★ ★

No. 2,662,662, STACKING STOCK BASKET, patented December 15, 1953 by John P. Moorhead, Dearborn Township, Wayne County, Mich., assignor to Wall Wire Products Company, Plymouth, Mich., a corporation of Michigan.

There are ten claims to this basket which is constructed of interconnected wire parts.

★ ★ ★

No. 2,662,693, COUNTER FOR COIL WINDING MACHINES, patented December 15, 1953 by Walter Sivo, Georgetown, and Henry S. Walendzik, Danbury, Conn., assignors, by mesne assignments, to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

This is a counting device for a winding machine provided with means revolvable relative to a core for winding a strand on the core with a loop between the winding means and the core moved along a predetermined path each turn.

★ ★ ★

No. 2,662,701, REEL APPARATUS FOR FORMING COILS OF CABLE, patented December 15, 1953 by Otto R. Weber, Louisville, Ky., assignor to Reynolds Metals Company, Richmond, Va., a corporation of Delaware.

A segmental cylindrical arbor is pro-

JLE

SERVING THE WIRE INDUSTRY THROUGHOUT THE WORLD

- Caterpillar Pull-outs
- Standard Sets of Spark-Testing Equipment
- Take-ups and Re-spoolers
- Reelers
- Coilers
- Spoolers
- Collapsible Coiling Reels
- Wire Sparkers and Accessories
- Hand Locators
- Electrode Units and Stands
- Measuring Machines, Counters and Accessories
- Wire Guide Units
- Pay-off Reels Stands
- Electronic Devices
- Shaftless Take-ups and Payoffs
- Wire Pre-Heater
- Disk Brakes and Controls, Drag Units and Slip Clutches
- Wire Marking Machines, Type Strips, Inks
- Labelling Machines
- Pneumatic Equipment and Controls
- Special Machinery for the Wire Industry
- Hydraulic Equipment and Controls
- Hi-Pot Test Sets
- Cable Handling Equipment for Warehouse Use

See Page 146 for News of JLE Automatic Reeling Measuring and Spark Testing Equipment

JAMES L. ENTWISTLE CO.

1475 ELMWOOD AVE. PROVIDENCE 7, RHODE ISLAND, U. S. A.

European & South American Agents: M. CASTELLVI, INC. 150 BROADWAY, NEW YORK 38, NEW YORK

British Associate: GENERAL ENGINEERING CO., LTD. BURY ROAD, RADCLIFFE, LANCASTER, ENGLAND

JLE JLE JLE JLE JLE

vided with flange segments which may be pivoted so as to render the arbor tapered. Special means is provided to retain a tie wire.

★ ★ ★

No. 2,662,931, SPIRALLY APPLIED, CONDUCTIVELY-CONTACTING CABLE ARMOR, patented December 15, 1953 by Wilbur E. Mougey. Summit, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York.

About the lead sheath surrounding the conductor wires is a coating of flooding compound, a pair of tapes of dissimilar material applied side by side over the compound in the same direction, a second coating of flooding compound applied over the tapes, a spirally wound metal cushioning tape embedded in the compound and applied in a direction opposite to that of said first pair of tapes, a third coating of flooding compound over the cushioning tape, a pair of metal tapes embedded therein, one of the tapes wound in a direction the same as that of the first pair of tapes, a fourth coating of flooding compound over the second pair of tapes and having a serving of jute roving thereover and a finish coat over the roving comprising a layer of flooding compound and a coating of non-adhesive material.

★ ★ ★

No. 2,662,932, SYNTHETIC CABLE JACKETING COMPOSITIONS, patented December 15, 1953 by Arthur J. Warner, Glen Ridge, N. J., assignor to Federal Telecommunication Laboratories, Inc., Nutley, N. J., a corporation of Delaware.

A jacketing composition for wire conductors comprises (by weight) copolymer of vinyl chloride and vinyl acetate 30-35; copolymer of acrylonitrille and butadiene 30-35; polyster of propylene glycol and sebacic acid 20-25; basic silicate of white lead 2½-5; dibasic lead phosphite 2-4 and low molecular weight polybutene 2-5.

★ ★ ★

No. 2,662,970, TROUBLE LIGHT, patented December 15, 1953 by Ralph E. Zediker, Buffalo, N. Y.

More specifically, the patent relates to a wire holder for the light.

★ ★ ★

No. 2,663,038, MACHINE FOR MAKING BED SPRINGS, patented December 22, 1953 by Charles H. Gail, Los Angeles, Calif., assignor to Spring Machinery Company, Los Angeles, Calif., a corporation of California.

A machine for producing a bed spring formed of spring coils and helical connectors and including helical connector-advancing means is disclosed.

★ ★ ★

No. 2,663,229, WIRE INSULATING APPARATUS, patented December 22, 1953 by Christopher J. Krogel, Cranford, N. J., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

The apparatus is adapted for pulp insulating of the wires.

★ ★ ★

No. 2,663,475, SPRING POCKET FILLING MACHINE, patented December 22, 1953 by William K. McInerney and James M. McInerney, Grand Rapids, Mich.

There are ten claims to the machine for pocketing helical wire in fabric pockets.

★ ★ ★

No. 2,664,372, ELECTRIC CABLE, patented December 29, 1953 by Philip Massey Hollingsworth, Sidcup, Kent, England, assignor to Johnson and Phillips, Limited, London, England, a British company.

More specifically there is disclosed a method of assembling an electric cable core in a metallic sheathing.

B.I.S.R.A.'s New Sheffield Laboratories

A small scale steelworks, specially equipped to try out new ideas, co-operatively owned and run by the 400 most progressive firms in the iron and steel industry was opened by the Duke of Edinburgh in Sheffield on November 19th. These laboratories of the **British Iron and Steel Research Association** have cost £500,000 and their unique equipment is already at work on many of the industry's most pressing problems.

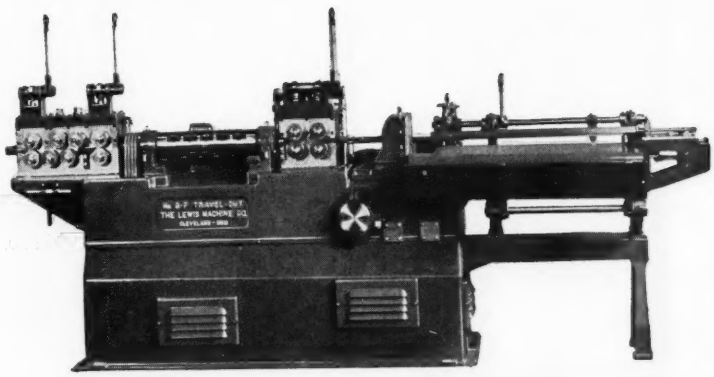
★ ★ ★

The wire-drawing machine can operate at up to 5,000 ft. per minute—the fastest for its size in the world. Normal wire drawing speeds have increased enormously during the last few years, and

Fast, Accurate, Economical

STRAIGHTENING and CUTTING

with LEWIS **TRAVEL-CUT**



22 Models to handle from .012" to ¾" Round, Hex, Flat, Shapes.

Simple in design, rigid in construction, Lewis TRAVEL-CUT will deliver continuous dependable service under the most severe, high production conditions—day in, day out. Feeds wire from the coil, straightens accurately, gauges to uniform length, and cuts clean without stopping the wire. For steel, brass, aluminum and alloy wire. Cut your cutting costs with the Lewis TRAVEL CUT. Full details on request.

Exclusive Representatives

EAST: Penn Machinery Co., 117 North Third Street, Philadelphia 6, Penn.

MIDDLE WEST: Steel & Wire Machinery Co., 15457 Euclid Ave., Cleveland 12, O.

CENTRAL: Moslo Machinery Co., 2443 Prospect Avenue, Cleveland 15, Ohio.

WEST COAST: Hoffman & Heartt, 3065 So. Grand Ave., Los Angeles 7, California.

CANADIAN: Empire Engineering Co., 738 Dundas St., East, Toronto, Ont., Canada

CONTINENTAL EUROPE: Gaston E. Marbaix Ltd., Devonshire House Vicarage Crescent, London S. W. 11, England.

The LEWIS MACHINE Company

3441 E. 76th Street, Cleveland 27, Ohio

Also agents in Paris, Stockholm, Rotterdam, Brussels, Zurich, Milan, Bombay and Melbourne

there is continual pressure for them to be increased even more for the sake of higher outputs.

★ ★ ★

Many types of steel wire, however, must still be drawn comparatively slowly for technical reasons largely concerned with lubrication, and this is one of the problems on which B.I.S.R.A.'s wire drawing machine is being used.

★ ★ ★

A technique has been devised for measuring the thickness of the film of lubricant on a wire while it is actually passing through the die. An oscilloscope trace indicates the film thickness (though this may be of the order of only 10,000 Angstrom units, or one thousandth of a millimeter), throughout the speed range. The machine can be "crash-stopped" by pressing the emergency button which brings the machine to a halt within two seconds.

★ ★ ★

All types of steel operations and processing will be conducted and studied in the pilot plant.

Refinishing Wire Drawing Dies?

Save Money with NORBIDE® Abrasive . . .

Second in hardness only to diamond which costs a hundred times more

Johnson Steel & Wire Co., Inc. has substantially reduced the cost of refinishing their wire drawing dies by substituting NORBIDE Abrasive for costly diamond dust. Excellent for ripping or for fast stock removal as well as for accurate semi-finishing operations.

High accuracy is important to Johnson for Johnson "music" spring wire is drawn in 200 different sizes, all the way from .003" to .200".

If you are still using diamond dust for your ripping and semi-finishing operations, you'll be amazed at the savings you can obtain by switching to NORBIDE Abrasive.

For cost-cutting abrasive details, write for Form 559.

NORTON COMPANY

45 New Bond Street • Worcester 6, Massachusetts

NORTON

BORON CARBIDE

NORBIDE® . . . the hardest man-made abrasive

Military Standards for Wire Screw Thread Inserts Established

New military standard sheets have been issued covering helical coil wire thread inserts (National Coarse and National Fine series) for aircraft applications.

★ ★ ★

Separate sheets list nominal lengths of one, one-and-one-half, two, two-and-one-half, and three diameters. Maximum and minimum tolerances are established for all characteristics of the inserts. Thread diameters range from .164-32 to 1.000-8. Since the inserts can be supplied notched for tang-breakoff in through holes, or unnotched for use in blind holes, separate part numbers are assigned to the notched and unnotched inserts.

★ ★ ★

These new military standards were developed with the Engineer and Propeller Utility Parts Committee of the Society of Automotive Engineers. In the past, Heli-Coil wire thread inserts have been approved for numerous individual military applications, including armor plate repair.

★ ★ ★

Copies of the Military Standard Sheets are available upon request from Heli-Coil Corporation, 1435 Shelter Rock Lane, Danbury, Conn.

New Distributor Named by Reynolds Metals

Appointment of a new distributor for Reynolds Aluminum mill products has been announced by **Reynolds Metals Company,** from its sales headquarters in Louisville, Kentucky. The new distributor is **Kasle Steel Corporation,** 8550 Brookpark Road, Cleveland 29, Ohio.

★ ★ ★

Kasle is completely equipped to supply all classes of aluminum mill products, such as flat and coil

sheet, wire, rod, bar, tubing, and extruded structural shapes.

★ ★ ★

The addition of the new distributor will provide better service and increase the availability of aluminum for users in the Cleveland area.

U. S. Rubber to Have New Research Center

United States Rubber Co. announced recently that it has acquired options to purchase a 90-acre tract of land in Preakness, N. J., on which it plans to construct a new research center devoted to scientific research and development in the fields of rubber, chemicals, textiles and plastics.

★ ★ ★

The research center calls for the construction of three new, modern laboratory buildings and service buildings at an approximate cost of four million dollars. The company's present research and development activities, now conducted in its general laboratories in Passaic, N. J., will be transferred to the new location.

★ ★ ★

Nearly 400 people, a large number of whom hold doctorates or other college degrees in chemistry and physics, will be employed Many people who will work in the new center now are employed at the Passaic laboratories.

New Catalog on Power Shears

A new highly-illustrated catalog, No. 2011-E, covering Steelweld Pivoted-Blade Power Shears, has just been completed by **The Cleveland Crane & Engineering Co.**, Wickliffe, Ohio.

★ ★ ★

Dimensions and specifications are given for 31 different sizes of shears in the regular line, ranging from 6 feet by 10 gauge to 12 feet by one inch capacity. Larger Steelweld Shears have been built, however, for cutting steel to 24 feet by ¼ inch.

★ ★ ★

Catalog No. 2011-E will be furnished free upon request.

Issues Reference Guide to Processes for Metal Preservation

American Chemical Paint Company, Ambler, Pa., has issued a handy and quick reference guide to chemicals and processes for preserving metals. It is called a "Check List", and contains in tabular form a list of products, types of metals to which suited, the object of the coating, the methods of application and other useful data. A copy of the Check List will be sent upon application.

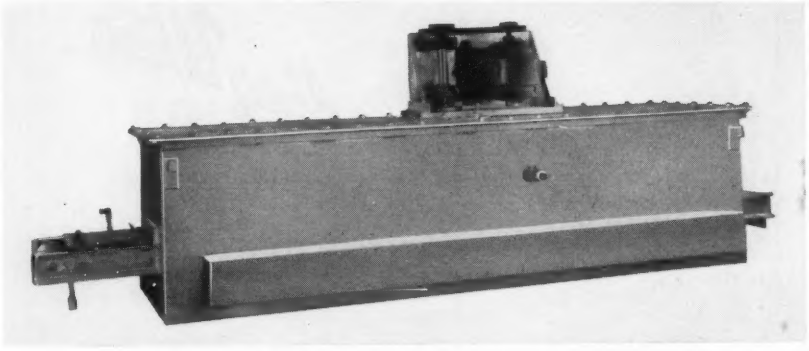
New Hand-Type Wire Stripper

A completely automatic wire stripper that eliminates triggers, cocking or other holding devices is being introduced by **Holub Industries, Inc.**, Sycamore, Illinois. It is called the "Hi-Speed" Wire Stripper.

★ ★ ★

The "Hi-Speed" is designed to strip all kinds of building and fixture wire with a single squeeze of the handles. After the wire is stripped, a concealed cam holds the

ROCKWELL BUILDS
Complete Processing Equipment for Magnet Wire
ENAMELING • TINNING
GLASS COATING • SYNTHETIC COATINGS



Rockwell continuous, recirculating oven for annealing 16 lines of wire in protective atmosphere. Part of a complete wire enameling installation. Can be used for copper, brass and low carbon steel wire at temperatures to 1200°F.

Also continuous annealing or hardening lines for all types of ferrous and non-ferrous wires.

We Invite Your Inquiries

We are pleased to announce that the wire processing equipment division is under the direction of Mr. O. S. Haskell.

W. S. ROCKWELL COMPANY

ROCKWELL SINCE 1888 BUILT

FURNACES • OVENS • BURNERS • VALVES • SPECIAL MACHINERY

2424 ELIOT STREET • FAIRFIELD, CONN.

Sales Representatives in Principal Cities

jaws open until the wire is removed. This prevents the jaws from snapping back and crushing the wire, particularly stranded and fine solid wire. A blade adjustment screw increases the wire range of each stripper and compensates for variations in insulation thickness and adhesive properties.

★ ★ ★

The "Hi-Speed" Stripper is made in seven sizes for stripping Nos. 8 to 30 solid and stranded wires. Also POSJ, parallel wire and 300 ohm flat twin lead-in wire. An adjustable stop is furnished with each tool. Descriptive literature will be sent upon request.

Carboloy to Expand Plant

An expansion program of over $1,000,000 to be completed late in 1954 was announced recently by **K. R. Beardslee,** general manager, **Carboloy Department** of General Electric Company.

★ ★ ★

The program includes the addition of 36,000 square feet of floor space to the Department's metals building on East 8-mile road in Detroit, plus new engineering and manufacturing equipment.

★ ★ ★

The expansion will allow the organization to re-arrange its tool room production engineering and equipment development facilities, and make use of 16,000 square feet of vacated space for additional advanced engineering facilities such as pilot plant and laboratories.

Plan to Develop Interest in Science

The scientific achievements of today and the possible new developments of tomorrow call for an ever increasing number of skilled technicians and properly trained scientific personnel.

★ ★ ★

Plans to develop interest in scientific matters are being promoted through: (1) the **Future Scientists of America Foundation,** an activity of the National Science Teachers of America that is financed by the American Society for Metals; and (2) **"Science Fairs"** that are being held in various parts of the country in which any high school student may enroll. These fairs are designed to stimulate interest of students in science, to inform them of what is being done in scientific work and to encourage them to pursue scientific studies.

★ ★ ★

Means are provided to give recognition to exceptional abilities evidenced by students, with various awards to them for achievements in applied mathematics in engineering and in scientific projects.

★ ★ ★

Those concerns or individuals who would like more information on the subject, with the thought of doing something along these lines locally, may write to the Science Clubs of America, 1719 N Street, Washington 6, D. C.

New Tension Meter Announced

A new Tension Meter of advanced design has been put on the

SCOVILL
MILL PRODUCTS
BRASS ★ BRONZE ★ NICKEL SILVER ★ ALUMINUM

ALWAYS CLOSE AT HAND

IT'S EASY TO SEE WHY "TOUGH-TO-MAKE" COLD-HEADED BRASS PRODUCTS CALL FOR

Cold-Heading Wire

The availability of two closely controlled tempers makes possible more nearly perfect fabrication of cold-headed brass parts from wire of requisite "flow" characteristics (for heading and extruding), or of essential rigidity (for secondary machining). These two tempers are suitable for 99% of your cold-heading operations.

Scovill Extruded Cold-Heading Wire virtually eliminates—by reason of its higher copper content, production by the Hot Extrusion process, and closely controlled tempers—such defects (attributed to wire) as:

1. Split heads or shanks.
2. "Out-of-round" heads.
3. Inadequate filling out of heads and shoulders.
4. Rough "orange-peel" effect.

Let us help you select the proper applicable temper for A) HEADING and EXTRUDING, or B) HEADING and DRILLING. A trial run will convince you that there is an important difference in your products made from Scovill Extruded Cold-Heading Wire (Cartridge Brass, 70%).

You Can SELL the Difference

Write for full information to:

SCOVILL MANUFACTURING COMPANY

99 Mill Street, Waterbury 20, Connecticut, Waterbury 4-1171

10SC54B

market by **Tensitron, Inc.** of Harvard, Mass. It has been added to the line of tension measuring instruments developed by Dr. Saxl, known in industry for his designs of tension measuring and tension controlling equipment. The new Tension Meter is a high-capacity instrument capable of handling substantial tensions of 20 pounds and more such as used in the making of wire and cables. The same instrument also is produced with wider rollers for the measurement of strands of rayon tow as well as for the tension of paper strips, plastic tapes, slit film and other cut strips.

★ ★ ★

The instrument is built under the Saxl patents. It is larger in capacity and thereby accommodates significant tensions exceeding the sensitive Tension Meter used heretofore. In addition it has the major advance over prior designs in that the meter completely eliminates the use of gear trains. A basically new movement for Tension Meters is used which assures permanent operations under the rugged requirements of industrial practice, with complete freedom from gear teeth and their deformation.

★ ★ ★

For further information write to Tensitron, Inc., Harvard, Massachusetts, Dept. W. P.

High Temperature Hook-Up and Lead-In Wire for Class H Service or Better

Stranded copper, silver-plated hook-up wire is now available from **Hitemp Wires, Inc.** Tradenamed "Temprene", the wire is supplied in 11 solid colors and over 100 combinations of striped insulation. Standard sizes range from 10—28 AWG, in both thin and heavy wall thicknesses.

★ ★ ★

Temprene hook-up and lead-in wire is insulated with Teflon. It is capable of continuous duty at −100°C to +260°C without deterioration, and remains unaffected by outdoor weathering. Electrical and chemical properties are excellent over a wide range of frequencies and temperature. The wire conforms to the requirements of MIL-W-16878 (ships).

★ ★ ★

Dielectric strength of the hook-up wire is 1000V per mil, volume resistivity is 10^9 megohms per cm. The dielectric constant is 2.0—2.05 at frequencies from 60 cps to 30,000 mc. There is no known solvent for the insulation; it is nonflammable and will not support fungus growth. Water absorption rate is zero.

★ ★ ★

More than 20 combinations of stranding are available as standard, depending on the gauge required. Other strandings and special wall thicknesses can be supplied on request. Hitemp will also furnish hook-up wire with shielding or Teflon impregnated glass fiber braids. Multi-conductor cables of various constructions to suit user requirements are also available on custom order. For additional information, write Hitemp Wires, Inc., 26 Windsor Rd., Mineola, L. I.

WILLEY'S
TUNGSTEN CARBIDE

METALS
DIES
TOOLS
for the Wire Industry

Rough Cored Standard Dies
(from stock)
ROUND SQUARE HEXAGON OCTAGON

Rough Cored or Finish Ground
(Immediate quotations on receipt of your prints—
Fast delivery schedules)

SPECIAL DIES WEAR PARTS MANDRILS
NIBS—HEADING AND EXTRUSION DIES

For complete information:

Willey's Carbide Tool Co.
1340 W. VERNOR HWY. • DETROIT 1, MICHIGAN

An Unsolicited Tribute

Direct returns from advertising are a great satisfaction to an advertiser—and to a publisher, if he is fortunate enough to learn about them.

Reproduced here are two letters; one from a reader in a far-off country and the other from the advertiser to us—both of which we appreciate his thoughtfulness in sending:

From A/S Norsk Electrisk Kabelfabrik, Oslo, Norway to Acrometal Products, Inc., Minneapolis, Minn.

"About one year ago an old friend of mine came to see me at my office in Oslo. This friend was Mr. G. Heggen-Hansen of the James Mackie Company, Belfast, Ireland, the sales representatives for Europe of Wardwell Braiding Machine Co., R. I.

During the conversation he showed me some spools which were no good in my opinion, and I said to him: 'Look here, I will show you a really first-class spool', and I handed him one of yours which I had recently received. He examined it with interest and admiration and answered: 'This must be something for Mr. Birchmaier (of Wardwell), I will report to him'. He got your name and address and brought your spool with him as he went.

Today I notice in Wire and Wire Products, August 1953, your advertisement and wonder if there is a connection between it and the conversation mentioned above. If so, it is interesting, I think, that this business started so far away."

From Acrometal Products, Inc. to Wire and Wire Products

"I most certainly want to continue using the special position in 1954. Our advertising in Wire and Wire Products has shown tremendous results and we have no intention of decreasing our advertising appropriation for 1954 as far as Wire and Wire Products is concerned.

I want to thank you for the grand spirit of cooperation which you have personally shown in working with us on our advertising program in your publication."

It is interesting to note that as a result of the above letter, a nice new account was opened by Acrometal.

WIRE AND WIRE PRODUCTS literally goes into the far corners of the earth—to some 30 countries—as well as covering the industry at home.

Over the years we have had dozens of such fine tributes to the effectiveness of our magazine as an advertising medium.

Advertising does pay. It will be our pleasure to tell you how and why. Please write.

WIRE AND WIRE PRODUCTS

J. Edward Donnellan, Vice Pres.

453 MAIN STREET **STAMFORD, CONN.**

Tel.: Stamford 3-0482

New Di-Profiler Works Carbide Dies

Tungsten Carbide Dies can be repaired, altered and even produced from blanks of pre-sintered carbide by using the new Di-Profiler, a product of **Nord International Corp.**, Denville, N. J. according to its President, Harold Hedstrom.

★ ★ ★

As an example, the work stages in the making of a triangular shaped drawing die with this tool are as follows:

1. **A hole is made in the pre-sintered die blank by means of a rotary diamond grinding tool and then given a triangular shape.**
2. **Final sintering.**
3. **Bring to near-size with diamond files.**
4. **Lap with coarse diamond compound.**
5. **Lap with medium diamond compound.**
6. **Lap with fine diamond compound.**
7. **Lap with extra-fine compound.**

★ ★ ★

The "vibrationless" operation of the Di-Profiler astounds people familiar with the usual hand grinder or vibrator. It is actually vibrationless, even when used at long stroke (which may be adjusted from 0" to .250"). "Fifty times faster than by hand" is the fair estimate of those who have used the Di-Profiler. There are dozens of applications for which it is perfectly adapted. The action is reciprocating and oscillating at will, and when used with the spindle attachment, a finely controlled rotary action may be obtained.

★ ★ ★

For repairing or working carbide dies, a wide variety of diamond files are available from Nord in standard and special shapes, in addition to a complete line of burs in round, inverted cone, straight (crosscut), taper (crosscut) and other standard or special styles. Special holding fixtures for other work are also available.

★ ★ ★

For further details please write **—Nord International Corp.**, P. O. Box 44-N, Denville, N. J.

High Temperature Magnet Wire

A line of magnet wire in a wide range of sizes, for class H service or better and with outstanding electrical properties, has been announced by **Hitemp Wires, Inc.** Insulated with Teflon, the wire has a low loss factor, low dielectric constant (2.0—2.05 from 60 cps to 30,000 mc), an excellent dielectric strength. Characteristics remain stable at temperatures from —100°C up to +260°C. Insulation is non-flammable, completely inert to moisture and all known commercial solvents and chemicals.

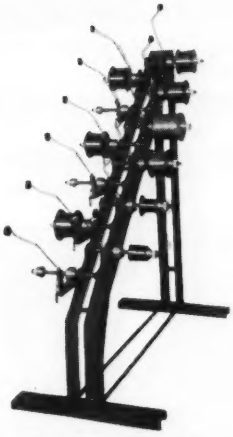
Because of its high electrical stability, Teflon coated wire is recommended for high-temperature and high-frequency applications—especially where miniaturization is a design factor, or where chemicals and solvents are encountered. Present applications include: motors, generators, alternators, and convertors; transformers, relays and solenoids; delay lines, chokes and filters.

Hitemp will also insulate special alloy wires to specifications. For more information, write Hitemp Wires, Inc., 26 Windsor Rd., Mineola, L. I. Literature is available.

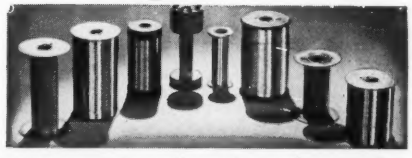
STANDARD UNI-DRIVE WIRE WINDER

INCREASE YOUR PRODUCTION
WITH THIS WINDER

Wire Winder



Pay-off Attachment



Various types of supply packages that may be wound on Standard Uni-Drive Wire Winder.

PAYOFF

Our payoff attachment is made with self-aligning ball bearings and a compensating attachment to control the tension of each end. Applies same tension when spool is empty as when full.

The new Uni-Drive Winder with Payoff Attachment is new in design and incorporates several improved and tested features. Production is stepped up through increased speed. It produces smooth, even and accurately wound spools of wire in single or multiple ends. All strands parallel—no over or under-winding. Automatic Stop-Motion controls each strand. Compensating attachment produces perfectly controlled tension. Traverse adjustable from 1¾" to 5½" between spool heads without changing cam. Designed especially for winding wire to be braided and shielded for electrical conductors up to ¾" diameter.
Payoff can be equipped with Carboloy Guide Inserts at additional cost.

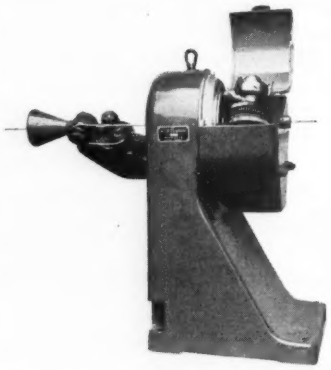
STANDARD MILL SUPPLY COMPANY
PAWTUCKET, RHODE ISLAND, U.S.A.
1064-1080 Main St.
PAwtucket 3-1534 — 3-1535 — 3-1536

LINÉ-GORCY

MECHANICAL

WIRE ROD DESCALERS

(Patented in U.S.A.)



Built for—
Efficient
Low Cost
Dry Cleaning of
Hot Rolled Rods

PROOF for 1954!

1.—The excellent, productive performance of the
LINÉ-GORCY DESCALER
has been fully demonstrated in
TWENTY
Wire Mills in the U.S.A.

2.—Likewise, the excellent performance of the
WEMCO MOLTEN METAL PUMP
has been approved by
TWENTY
users in the U.S.A. and Canada.

FISHER ASSOCIATES

EXCLUSIVE DISTRIBUTORS
122 East 42nd Street
New York 17, N. Y.
Telephone: OXford 7-3294

WEMCO MOLTEN METAL PUMP

(Made in U.S.A.)

Air Driven
for
Rapid Transfer
of
Molten
ZINC
LEAD
ALUMINUM
TIN
THEIR ALLOYS
and
HEAT TREATING SALTS

Built
for
Intermittent
or
Continuous
Usage

WAFIOS

WIRE-WORKING MACHINERY

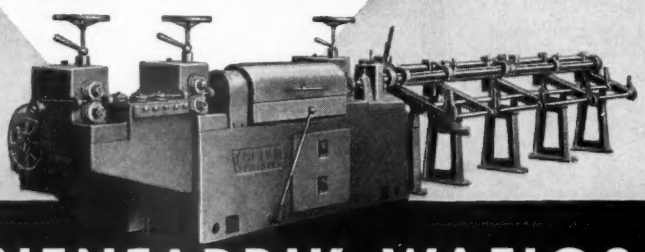
Wire Netting Machines for Chain Link, Hexagonal Mesh, Poultry Netting, Field Fence. Crimping, Barb Wire and Staple Machines. Spring Coilers. Spring End Grinding Automatics. Loop Benders. Upholstery Spring and Wire Mattress Machines. Wire Nail Machinery. Chain Formers. Chain Welders. Straightening and Cutting Machines. Multi-Slide Wire and Strip Forming Machines. Special Machinery for the making of Paper Clips, Lock Washers, Bale Ties, Key Rings, Tin Openers, Wire Bag Ties, etc. Automatics for Flexible Metallic Tubing.

Kurt Orban Company, Inc., 205 East 42nd St., New York 17, N. Y.

Sole Agents for Australia and New Zealand: Bliss & Reels Co. Pty. Ltd., 64-66 Little Bourke Street, Melbourne C. 1, Australia.

WAFIOS

SINCE 1893



MASCHINENFABRIK WAFIOS

WAGNER, FICKER & SCHMID **REUTLINGEN 3 / WÜRTT. GERMANY**

Production Begun in New Puerto Rican Wire Mill

Production has started in the first building of the large mill that **Gulf Steel & Wire Company** is erecting in Bayanon, Puerto Rico, it was announced in December by the President, **Charles G. Raible.**

★ ★ ★

Mr. Raible is assisted by men with long experience in their respective lines. Among them is **L. D. Seymour,** Executive Vice President and Works Manager, who is a former President of The Wire Association. He has been Manufacturing Manager of the Canada Works of the Steel Company of Canada, Ltd. and has held executive positions with Roebling's, Youngstown Sheet and Tube and American Steel and Wire.

★ ★ ★

Plant "A", built for the production of wire, nails and chain, is in production now. Plants "B" and "C", occupying an area of 200,000 square feet, are now under construction and will be inaugurated in May, 1954.

Boosts Previous Record with Million-Ton Production

Breaking all previous records, the four blast furnaces at the Pueblo plant of the **Colorado Fuel and Iron Corporation** produced more than a million tons of iron in 1953, according to **A. F. Franz,** president.

★ ★ ★

The million-ton mark was passed at midnight, December 1, representing a considerable increase over the former record of 867,158 tons set in 1951.

★ ★ ★

Mr. Franz pointed out that much credit for the new record is due to the fine work of CF&I's employees. "Their cooperation, coupled with recent improvements in preparation facilities and reconstruction of blast furnaces, have made possible this outstanding production accomplishment," he said.

★ ★ ★

With 12 plants in seven states, Colorado Fuel and Iron is the ninth largest steel producer in the United States. Recent improvements in facilities of the Pueblo plant have been made as part of CF & I's long-range program of modernization and expansion in all operations of the corporation.

Enters Heavy Press Field with Introduction of Wickliffe Presses

The Cleveland Crane & Engineering Co., Wickliffe, Ohio, announce their entry into the heavy press field with the introduction of a completely new line of presses ranging from 160 tons capacity and up.

★ ★ ★

The new machines, to be known as Wickliffe Presses, will supplement the Steelweld Bending Press and Shear lines which were originally developed and introduced by the company many years ago and are now in extensive use. They are intended for uses such as forming, blanking, piercing, trimming, light embossing and drawing.

NILSON FOUR-SLIDE
It's easy to get
HIGH PRODUCTION
... and UNIFORMITY, too!
Wire and Ribbon Metal
FORMING MACHINES
UNIFORMITY in automatic production doesn't come by chance! In the case of wire and ribbon stock forming on NILSON 4-SLIDES, it means control of the material from the coil to the final form.
Parts, such as illustrated, are produced to tolerances of .002 at critical dimensions. Dies and forming tools, once installed (faster and simpler with NILSON'S open construction) maintain close tolerances for short and long runs. One machine! One set-up! Increased production! Maximum uniformity!
Model SF3 NILSON 4-SLIDE, shown above, with No. 51B Tilting Stock Reel, is a complete unit that can be set-up in any convenient location.
Range of sizes
Wire Forming — 1/32" through ½" wire. Feeds up to 32".
Ribbon Stock Forming — 3/32" through 3½" wide material. Capacity of press section 5 to 30 tons; 50 to 75 tons in heavy duty types.
Close-up of the NILSON forming section with the built-in Horizontal Press to the left. This design eliminates secondary handling and insures product uniformity because the sequence of stamping and forming is automatically controlled.
Close-up of the NILSON feed mechanism . . . capable of feeding wire and ribbon metal to tolerances of .001. Another important element in insuring product uniformity. Positive control is maintained over the material regardless the length of feed.
For specific recommendations — send details of your operation.
THERE'S NILSON EQUIPMENT FOR EVERY FORMING LIKE A
NILSON has been specializing in Forming Equipment for over 50 years.
THE A. H. NILSON MACHINE COMPANY
1516 Railroad Avenue • Bridgeport 5, Connecticut
CHICAGO • CLEVELAND • DETROIT • LOS ANGELES • HAMILTON, ONT., CANADA
Automatic Chain-Making Machines • Automatic Staple Forming Machines • Wire and Stock Reels • Foot Presses • Wire Straightening Equipment • Slide Feeds for Presses

Under development for over three years by some of the foremost engineers in the press field, the new presses, which are mechanically operated, include the latest features production men require for high-speed mass-production runs. They are generously designed throughout to provide great rigidity, long life and minimize maintenance. All parts are readily accessible and, should occasion demand, very easily removed and replaced.

★ ★ ★

Inquiries for the above presses, as well as for double-action, gap and special presses, are invited.

New Clutch Reel has Automatic Stop Control

A new type medium size wire and stock reel designed with a 4" oscillating movement is now being manufactured by the **A. H. Nilson Machine Company,** 1523 Railroad Avenue, Bridgeport, Conn. The oscillating feature reduces the load on the feed mechanism of the machine and, by means of a limit switch, automatically stops the machine in case of wire entanglement on the reel.

★ ★ ★

Used with medium size wire coils, the new Clutch Reel is specially useful in shops where one operator handles more than one machine. A spiral spring holds back the coil which is suspended and pivoted to a vertical shaft. The 4" oscillating movement compensates for pulls on the stock thereby reducing the load on the feed and prevents stock slippage. Overtravel of the reel beyond the 4" oscillating movement will automatically stop the machine through use of a limit switch.

★ ★ ★

The Nilson Clutch Reel is furnished in 2 sizes. The Model 51-L has a coil capacity of 175 pounds and an 8" minimum inside diameter. The Model 51-M has a 250 pound coil capacity and a 12" minimum inside diameter.

★ ★ ★

For complete information on the Clutch Reel and other Nilson Wire and Ribbon stock reels, write to the company.

New Booklet on Cut-Off Wheels

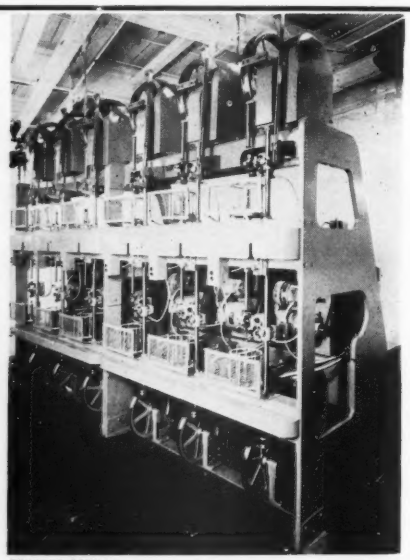
Norton Company of Worcester, Mass., announces a complete revision of its booklet, "Norton Cut-Off Wheels." While this is a revision, it contains much information which is completely new and up to date.

★ ★ ★

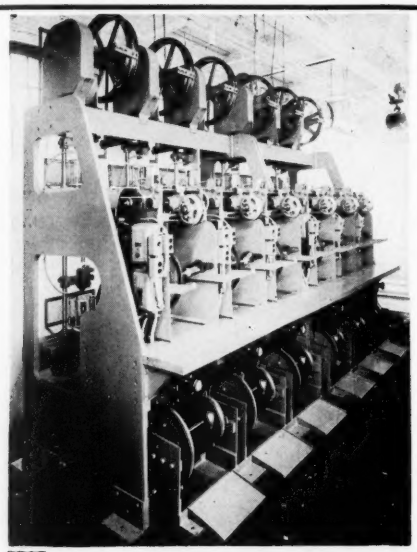
This 36-page instructive manual gives information on various types of cutting-off machines and abrasive cut-off wheels, their selection, application and proper usage; also photographs of typical cutting-off operations, and various helpful tables for wheel selection and conversion of wheel speeds to feet per minute values.

★ ★ ★

This booklet may be obtained without charge or obligation by writing to Norton Company, Worcester 6, Mass.



FRONT VIEW



REAR

3D-6-MBB TAPING MACHINE #1107

Applies double cover to 6 lines of wire simultaneously. Nominal wire range #6 to #18 B & S gauges (.162" to .040" or 4.116 MM to 1.024 MM). Standard Capstans 24" in diameter. Supply wire let-offs and torque motor driven take-ups for 24" diameter reels are at rear of machine.

EST. 1855 AIMco INC. 1915

"American" AIM INSULATING MACHINERY COMPANY

REG. U.S. PAT. OFF.

FAIRHILL AND HUNTINGDON STREETS

PHILADELPHIA 33 PENNSYLVANIA U.S.A.

New Westinghouse Floating Gearmotor

Westinghouse has now provided an answer to gearing drive problems where special conditions such as minimum space or peculiar operating conditions must be met through the development of gearmotors of the so-called "floating" type.

★ ★ ★

The general construction is such that the drive may be directly mounted on the shaft of the driven machine thus eliminating the use of couplings with possible misalignment problems.

★ ★ ★

A torque arm is provided to keep the unit from turning, and also to absorb pulsations from the driven roll.

★ ★ ★

The general principles of such a drive are not necessarily new as it was used as early as 1934, particularly in the field of separate speed reducers. The addition of the motor thus providing gearmotor construction makes this a complete drive package without the use of auxiliary belts and pulleys. These drives can be furnished as either parallel shaft helical drives or as right angle units of worm type for such applications as special machines, conveyors, table rolls and the like.

★ ★ ★

The unit exhibited is of the right angle worm type and of a design particularly adaptable to mill table rolls with the motor located vertically below the gear unit, thus protecting the motor from falling materials. A spring mechanism on the torque rod cushions shock loading caused by possible distortion of the roll.

★ ★ ★

Units of this type can be furnished with motors located either vertically up or down to suit operating requirements.

★ ★ ★

For added information, write to **Westinghouse Electric Corporation,** Box 2278, Pittsburgh 30, Pa.

New Extrusion Press for G.E. Laboratory

The new General Electric Research Laboratory in Schenectady will be equipped with the most up-to-date Extrusion Press for all high-temperature ferrous metals, such as carbon and stainless steels including austenitic types and nonferrous materials as copper, light metals and titanium. **Hydropress, Inc.,** in New York, has been awarded the contract on the basis of their newly developed designs in the hydraulic press field.

Tables Covering Plastics Properties Available

A series of tables giving chemical and physical properties of fifteen different plastics has been compiled and is now available without charge.

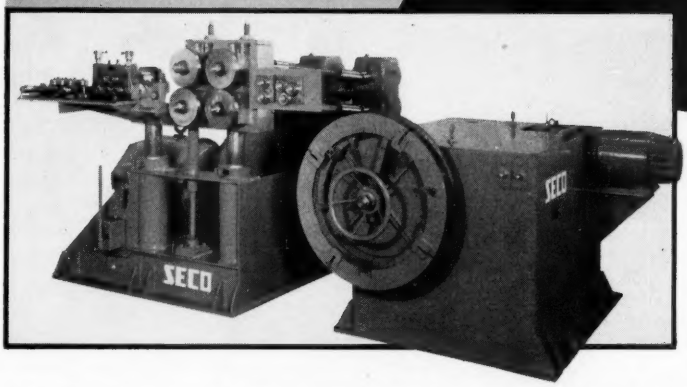
★ ★ ★

For further information, write the **Atlas Mineral Products Co.,** Mertztown, Pa.

Outstanding Features Superior Performance

NEW Heavy Duty COILER for Electrode Wire

DOES ALL THESE OPERATIONS



1 - STRAIGHTENS 2 - MEASURES 3 - FEEDS 4 - PRECASTS 5 - COILS

This Coiler handles welding wire of 3/32" to 3/8" diameter at 200 to 800 F.P.M. on blocks of 12" to 25" diameter.

Mechanically it consists of two separate units: the first doing the straightening, measuring, feeding and pre-casting of the wire, the second doing the coiling only.

Electrically both units are tied together in as much as all motors are controlled from one VS drive and control unit.

Write for full information and data—or consult our engineers on your coiling problems—no obligation.

- Puts a predetermined cast in the wire prior to its coiling on the block.
- Makes a traverse wound coil which will easily uncoil although being close and tightly wound with no danger of springing open.
- First unit equipped for hydraulically raising or lowering the entire roll assembly for proper lineup with the block diameter.
- Complete control over traverse mechanism for delaying reversal at stroke ends.
- Compact construction with easy accessibility to all moving parts.

STEEL EQUIPMENT CO. 20805 AURORA ROAD CLEVELAND 22, OHIO

SECO

A Reply to a Criticism of the Increasing Load Wire Abrasion Tester

(*Continued from page* 169)

time for analysis. No wire testing laboratory can afford to spend this much time on deciding between two wires; the answer to acceptability of a wire must be obtainable in a few minutes, preferably directly from instrument readings. The author has seen many cases where the unhappy alternatives were to do enough testing to get a complete picture or to test fewer specimens, hoping the value obtained reasonably represented wire quality.

★ ★ ★

Test experience has shown that if Wires A and B were tested on the Increasing Load Tester the following would be typical values: (See table foot of page 169).

★ ★ ★

These are not values predicted from a curve; they are typical measured values. Because the results have smaller spreads the difference between A and B becomes more immediately apparent. Had we tested only Specimens 1 and judged by average values, we would have said B is 1.6 times as good as A. Had we tested Specimens 5, we would call B 1.2 times as good as A. With this tester, B is always better than A, judged by averages and the ranges do not overlap.

★ ★ ★

Admittedly these results would not be expected from Dr. Levi's curve on Page 360. The reason is, work of abrasion is an exceedingly complex quantity. Abrasion resistance is compounded of many factors which vary along a wire—hardness, toughness, brittleness, inequalities in copper surface, bends in the specimen, surface roughness, lubricants present on the surface. There are also variations in test devices due to variable friction in the driving mechanism and changes in the surface of the abradant element. The Increasing Load Tester reduces the effect of many of these factors.

★ ★ ★

If it is admitted that most of the variations are in the wire rather than the test device, the Repeated Scrape Tester has accurately shown us all the variations in abrasion resistance, but it has also confused us by presenting data which requires statistical analysis (and takes too much time to accumulate). Because fewer tests are required, the Increasing Load Tester saves time and since the test values vary less, statistical analysis is not required. Admittedly, we do not see all the variations when we use the Increasing Load Tester, but are they of practical importance? We cannot correct our process for each variation and when we come to use practical lengths of the wire it will be a matter of pure chance whether abrasion occurs on a tough area or a weak one.

★ ★ ★

To return to Dr. Levi's definition of accuracy, there is nothing in the results from the Increasing Load Tester to indicate that it does not give "more reliable indications of the abrasion resistances." It is less sensitive to variations in abrasion resistance along a wire than the

MAILLEFER S.A.
RENENS-LAUSANNE (SWITZERLAND)
MACHINERY FOR THE WIRE INDUSTRY

MANUFACTURING PROGRAM

CABLE AND WIRE ROPE MAKING MACHINERY of every description.
HIGH-SPEED BUNCHING MACHINES.
HIGH-SPEED STRANDING MACHINES.
STRANDING MACHINES for absolutely tortion-free Wire Ropes.
PLANETARY STRANDERS for all duties, especially for hollow, sectorial, and pre-formed sectorial cables.
MACHINES FOR THE TELEPHONE CABLE INDUSTRY.
CLOSERS.
ARMOURING AND PARKWAY MACHINES.
TAPING AND INSULATING MACHINES for paper, cotton, silk, or rubber.
EXTRUDERS for rubber or plastic.
COMPLETE EXTRUDING INSTALLATIONS
INSULATING MACHINES FOR BERGMANN TUBES AND ARMOURED WIRE.
SPOOLERS, COILERS, REWINDERS.
LET-OFFS.
CONTINUOUS TAKE-UP UNITS. Integral capstan or caterpillar types.

Repeated Scrape Tester, but it will enable us to make a practical decision on two wires with less difficulty. Would Dr. Levi consider an instrument like the Repeated Scrape Tester which gives such widely scattered results that only statistical analysis will interpret them more "accurate" than a device which separates the wires more clearly by reducing the number of overlapping values?

★ ★ ★

One other point of disagreement exists. It has been my observation that the nature of the abrasion action is different in the Increasing Load Tester. In the Repeated Scrape Tester the needle tends, in many cases, to ride on the surface before breaking through for a number of strokes which varies widely depending on surface roughness and the presence of minute amounts of lubricant. In the Increasing Load Tester we pass quickly to a load which breaks the surface and causes the needle to begin to abrade the body of the enamel.

★ ★ ★

Dr. Levi speculates that "a large number of samples **may** still have to be tested" and that "compression of the values **may** cloud the issue". Practical experience in operating the tester has shown that these fears are groundless, and that statistical analysis is not needed to interpret the results.

★ ★ ★

In view of these facts, based on actual experience, I am sure the Increasing Load Tester gives results more quickly, and that it is more accurate because its values are "more reliable indications of the abrasion resistances of the samples tested."

Roger E. Gay Stresses Need for Standards at A.S.A. Meeting

A plea to American business management to avoid confusion and unnecessary emergencies in future phases of the national economy by developing standards now was voiced by Roger E. Gay, president, **American Standards Association,** at the opening of the Fourth National Standardization Conference in New York in October. Mr. Gay is president of **Bristol Brass Corporation.**

★ ★ ★

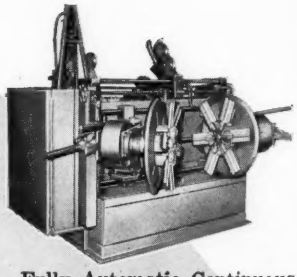
The alternative to building a comprehensive set of national standards now, Mr. Gay said, is to build them later in order to unscramble problems that should never have arisen.

★ ★ ★

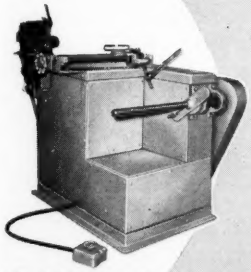
The opening meeting of the conference marked the 35th anniversary of the American Standards Association, which was founded in New York on the morning of October 19, 1918. Representatives of the five engineering societies and three Federal departments that founded the association were present.

FOR FASTER MORE EFFICIENT WIRE PRODUCTION . . . .

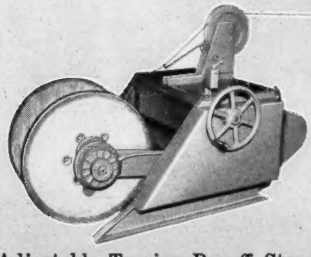
W I M **EQUIPMENT**



Fully Automatic Continuous Coiler and Respooler



Variable Speed, Constant Footage Respooler



Adjustable Tension Payoff Stand

Designed for more efficient wire production, WIM equipment is engineered to save you time, money and effort. Smooth high speed performance is assured. Continuous dependable operation is featured. The result is a line of wire handling machines that will handle your toughest jobs with little or no servicing. Write today for further information. Our engineering staff will be glad to help work out your problems.

W I M

WIRE INSULATING MACHINERY, INC.

Division of Machinery Electrification, Inc.

98 UNION STREET WORCESTER 8, MASS.

On to Worcester for the

WORCESTER REGIONAL MEETING!

April 22nd and 23rd, Sheraton Hotel, Worcester, Mass.

TENTATIVE SCHEDULE OF EVENTS

THURSDAY, THE 22nd:
8:00 A.M.—Registration Desk Opens On Mezzanine.
10:30 A.M.—Directors' Meeting; 12:00—Directors' Luncheon.
2:00 - 5:00 P.M.—Ferrous Technical Session in Baroque Room.
2:00 - 5:00 P.M.—Non-Ferrous Technical Session in Crystal Room.
6:15 - 7:00 P.M.—Cocktail Hour—Open To All Who Register.
7:00 P.M.—Banquet—Open To Ladies.

FRIDAY, THE 23rd:
Ferrous Plant Visit To Palmer Works of Wickwire Spencer Steel Division, Colorado Fuel and Iron Corporation.
Busses leave Hotel at 8:30 A.M. Luncheon at Palmer, Mass.
Non-Ferrous Plant Visit to Cable Works, American Steel and Wire Division, United States Steel Corporation.
Busses leave Hotel at 9:00 A.M. Luncheon at Quinsigamond.

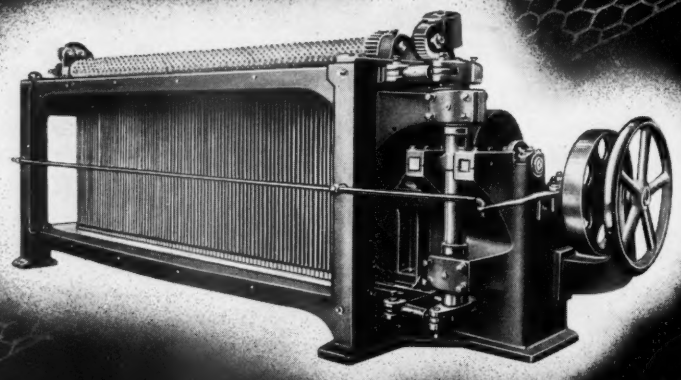
A special program has been arranged for the ladies.

Full details next month. Make your plans now to attend.

THE WIRE ASSOCIATION
RICHARD E. BROWN, Executive Secretary
300 MAIN STREET **STAMFORD, CONN.**

We build again: **Hexagon Wire Netting Machines**

Mesh widths 1/2" - 4"
Working widths 3' - 12'
for wire BWG 22 - 13 1/2



Model TUDN

SINCE **MALMEDIE** 1873
MASCHINENFABRIK GM BH DÜSSELDORF / GERMANY

Results of Research on Rubber Insulated Wire

(*Continued from page* 201)

in our experiments have been identified by specialists in this field. It is interesting that in our extensive studies such a small number of fungi have been found to cause these failures. This is in spite of the fact that there are undoubtedly hundreds of different types of fungi present in our active soil samples. It would appear that this ability to penetrate rubber insulation is not a property of all varieties of fungi but is confined to only a few.

★ ★ ★

Another type of experiment demonstrates the close relationship between electrical failure and fungus penetration. In order to see if the presence of fungi in a wall of insulation could be demonstrated before any electrical resistance failures had occurred, moderately thick walls of insulation were exposed to soil. After a sufficient period of exposure the samples were removed from the soil, washed and dried, and the surface was sterilized with iodine. Slices of insulation were cut at various depths and cultured under aseptic conditions. The rapid growth of colonies which started from various points in the slices demonstrated the presence of fungi in the interior of the insulation even though the electrical resistance had not yet dropped at all.

★ ★ ★

Until fungus hyphae have grown completely through the wall there should be little effect on the insulation resistance. It seemed reasonable, however, to expect them to lower the dielectric strength of the insulation. Moist hyphae can conduct electricity so that they would reduce the effective wall thickness of the insulation and thereby lower the breakdown voltage. A series of samples which had been exposed to active soil were broken down with both AC & DC stress. The normal dielectric strength for the insulation after being in water for the same length of time would be over 500 volts AC per mil and 1000 volts DC per mil.

High Quality

COPPER and BRONZE WIRE

ALL SIZES OF FINE WIRE . . . . BARE and TINNED

Spencer wire corporation

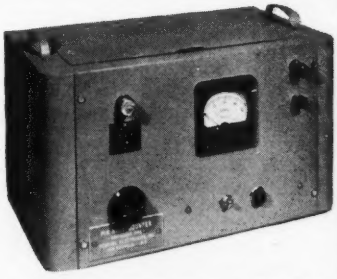
★ 555 LEHIGH AVENUE, UNION, N. J.

Plants at Union, N.J., Hillside, N.J., West Brookfield, Mass.

CONTINUOUS INSULATION TESTER FOR

MAGNET and OTHER FINE COATED WIRES

COUNTS AND RECORDS PIN HOLES AUTOMATICALLY AND ACCURATELY AT SPEEDS UP TO 600 FEET PER MINUTE.



FEATURES: 10 micro-amp fault detector • No damage to finest wire • No shocks • Moist felt electrode • No mercury • Check any length wire, up to 5 megohms • Detector operates counter, flashing lamp and rings bell • Accurate count—No repeats • Adjustable power supply and panel Voltmeter for single or multiple coated wire • Use in production lines following ovens or for inspection respooling.

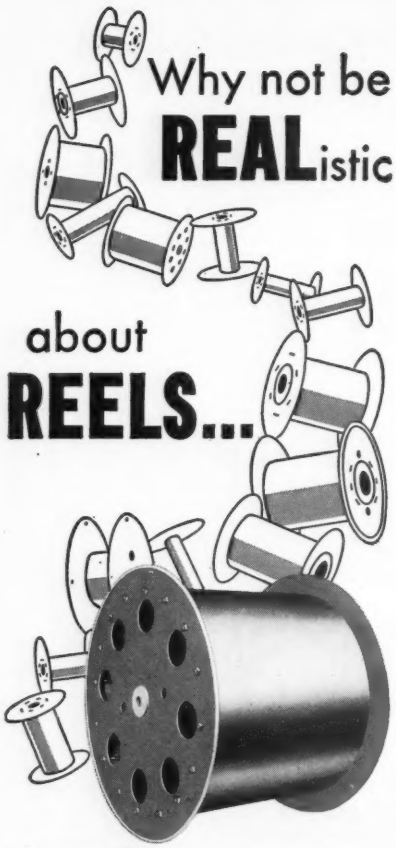
Hitemp Wires, Inc., Mineola, L. I., uses the Peschel Pin Hole Tester to certify high quality and to speed up inspection.

Other production and inspection testers available

Write for details

PESCHEL ELECTRONICS, INC.

13 Garden Street **Tel: NE 6-3342** **New Rochelle, N. Y.**



Why not be **REAL**istic about **REELS...**

It stands to reason that a company that's been doing a specialty job for more than 50 years really has the hang of it.

Apco Mossberg Company, for over a half century, has been everlastingly at the job of providing manufacturers of copper wire, steel wire and wire rope with all types and sizes of high quality steel reels, spools and bobbins.

Apco trained engineers consider each and every inquiry regarding steel spools, reels or bobbins separately . . . give individual attention to the design and construction to make certain that customers' requirements are carried out to the letter.

Reels are available in all sizes and shapes . . . for all applications. Write for further details today.

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The original Frank Mossberg Company

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The results in Table II show that even where penetration by fungus filaments had not been sufficient to lower the resistance, there was serious loss of dielectric strength. Although we have relied almost exclusively on insulation resistance measurements to detect failure from fungus attack, dielectric strength measurements can reveal incipient failures even before the megohms drop below normal values.

Table II

Insulation Resistance & Dielectric Strength of GR-S Insulations After 32 Months in Soil

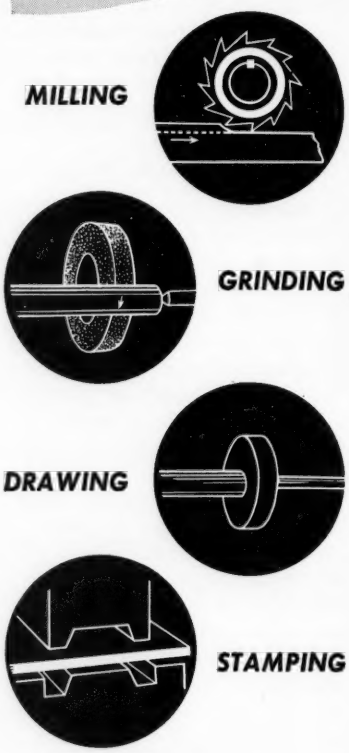
Mega-Megohms	Alternating Volts per Mil	Mega-Megohms	Direct Volts per Mil
3.7	276	4.4	468
4.2	284	5.0	516
4.5	91	0.006	262
0.006	82	0.003	163

For a fuller account of these studies the original papers (1, 2, & 3) should be consulted. It should be stressed here, however, that to demonstrate and study microbial attack **vulnerable** insulations were deliberately chosen. Obviously compounds completely resistant to such action would teach nothing in this regard. The accelerated tests were made under conditions which, although not unrealistic were incomparably more severe than those prevailing in ordinary service. This made it possible to screen out any vulnerable formulations in a relatively short time—weeks or months, instead of years. At the same time with such effective criteria of stability it has been possible to develop compounds that show indefinite life in the most active soil. Such compounds should possess a correspondingly prolonged life in service. To produce such stable compounds it has been necessary to incorporate fungitoxic materials. Both the types chosen and the amounts used are critical if a compound is to be sufficiently fungus resistant without serious loss of other necessary qualities. This requires a nice balance in the formulation.

★ ★ ★

In this paper some of the more recent technical studies have been discussed. Such studies are making

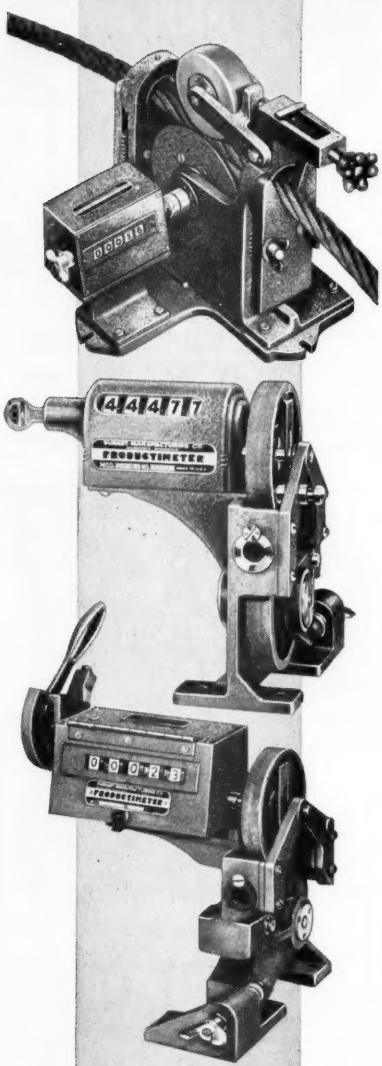
4 places to cut costs with Hans C. Bick Lubricants



Take up your lubricant problem with Hans C. Bick and discover how you can reduce costs through increased production and longer life for tools, dies, and abrasives. Bick lubricants and coolants are modern compounds developed by specialists with 23 years' experience. To assure best results, our engineering service is always available to work with you in a friendly, cooperative way. If you machine, form, or grind ferrous and non-ferrous metals, call upon Hans C. Bick now to smooth the way for lower unit costs.

Hans C. Bick, INC.
READING, PENNSYLVANIA

PRODUCTIMETER
WIRE MEASURING MACHINES
Fast . . Accurate . . Dependable . . Legible



Productimeters measure all types of wire from .010 to 1½ inches in diameter . . . at speeds up to 5,000 feet per minute. They eliminate "guess-work". . . insure profitable operation in your plant.

Send for Catalog No. 40

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Representatives in Principal Cities

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it possible to produce better and better rubber insulations. Some of the advantages of the synthetics over natural rubber have been pointed out. These and other superior properties account for the trend of the wire industry to the use of synthetics and away from natural rubber. The synthetics are getting better all the time and the possibility for further improvement in quality is great.

References

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2. Blake, Kitchin & Pratt. Trans. Am. Inst. Elec. Engrs. 69, Part II, 748 (1950). Rubber Chem. & Technol. 24, 399 (1951).
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The Manufacture of Rivets and Screws

(*Continued from page* 161)

production of first blows we have found to be impossible.

★ ★ ★

This is a major reason underlying the demand of the screw producer for uniformity of temper of raw material in any given lot. The blow which is satisfactory for soft wire is not satisfactory for hard wire. When there is both hard and soft within a single shipment, the rivet maker is in trouble.

★ ★ ★

Wire size and other small items have a very definite bearing on the success of the heading operation. I have seen times when a rivet maker wanted to reject a lot of wire because of an inability to extrude. The rejection was not justified at all, and the reason for the failure to extrude, was to be found in the header's setup. It was one of the little things frequently overlooked. That is the quality of the cut-off, particularly the squareness and configuration of the cut-off. It can be made very close to square, and it should be made very close to square. It is obvious when a blank butts upon a 30 degree extrusion angle, and if there is an uneven point, there is a decided tendency to bend to one side or the

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The Standard of the Wire Industry

other. This can completely destroy the proper tendency of the wire to extrude.

★ ★ ★

Cold heading is in a class by itself. It is not similar to any other metal working operation with which I am familiar. The distinguishing features of cold heading are not compatible with the properties which we would like to see in the secondary operations, particularly good machinability.

★ ★ ★

Roll threading can be a very complicated subject. I don't propose to go into detail concerning thread formation, because it is a subject on which a great many capable men have spent their entire lives and they are a long way today from knowing all the answers. However, I can tell you that roll threading is very severe cold work.

★ ★ ★

Consider that you are forming a 60 degree thread from approximately pitch diameter wire by forcing the crests of a threading die into the wire, thereby squeezing the stock enough to fill the thread roots of the die. This severe cold work will bring out any internal unsoundness of wire faster and better than any other metal working operation I know.

★ ★ ★

Internal segregation, and such things as shell pipe or extrusion pipe, are very rapidly brought out in the threading operation, although they may very well get by the heading operation. The roll threading operation also is affected by variations in wire temper. Soft wire in particular has a decided tendency to extrude during the threading operation, yielding longer blanks than those specified.

★ ★ ★

Mr. Chairman, I have talked at some length on the mechanics of screw manufacture. I could talk longer on the selection of alloys and the selection of tempers. However, I will touch on those two subjects only briefly.

★ ★ ★

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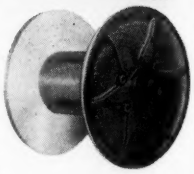

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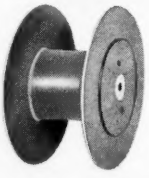

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THE WIRE ASSOCIATION
RICHARD E. BROWN
Executive Secretary
453 Main Street, Stamford, Conn.

Alloy selection, I will cover on the basis of my own experience. Other plants have different problems although we have much in common. On yellow brass, we prefer 70-30 brass cartridge brass for all around production of screws and bolts. The 65-35 analysis is used by others quite successfully, but we have found the severity of our operations makes the use of the more ductile alloy desirable. We do a great deal of work with silicon bronzes of two or three different analyses. We find that silicon bronze works in a manner quite similar to that of steel. It is a good heading alloy. We like it, and our customers are using a great deal of it today.

★ ★ ★

Copper is peculiar from the standpoint of a header man because it is so extremely ductile or malleable to a point, but beyond that point, copper cannot be forced. This is particularly true of blanks which have a large spread. I am talking about the width of the head as compared with the wire diameter. There is a very definite limit as to how far copper can be spread over the face of a die without failure on the outside periphery of the head.

★ ★ ★

Aluminum is very desirable as a heading alloy. We do a great deal of work with it. Our competitors most certainly do. We use it in a great variety of alloys and we have successfully threaded it in the soft temper or soft condition, and we have also roll threaded the heat treatable aluminum alloys after heat treatment. This operation must be carefully performed. The selection of temper is very much a matter of choice and it varies because of differences in shop practice.

★ ★ ★

Now, you will recall that there is an unsupported length of wire in the first three types of heading operations. It is that unsupported length of wire which makes temper critical. If the wire is soft enough to bend before it starts to upset, your heading operation is impossible. On the other hand, if

7 out of 9

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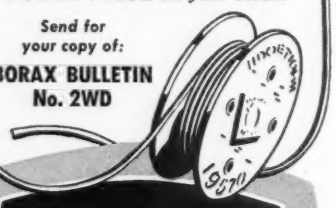

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the wire is too stiff, it will not upset properly, so once again the header man has to choose a temper which is intermediate between the hard and soft.

★ ★ ★

I might say from our own experience that when we are in trouble we generally go to a harder temper. We find that it is easier to overcome the difficulties in upsetting than it is to overcome the tendency to bend in the formation of the first blow.

★ ★ ★

One other point which I would like to cover is the desirability of some sort of reasonable laboratory means to evaluate the headability of wire. I had occasion on the 11th of August, to attend a meeting of screw producers and steel wire producers for the purpose of establishing a little better relationship, and among other things, to see if some means for evaluating headability could be found.

★ ★ ★

That work is in progress and it is a project which might be well undertaken by some of the nonferrous producers of wire. Header men, by and large, are prima donnas and they have a great many peculiarities in their specifications for raw material. I have no doubt they have caused trouble for wire producers. I believe that a very much greater degree of uniformity can be established for wire tempers. However, it will have to be done by the concerted action of groups like yourselves and the trade associations of the various types of screw products.

★ ★ ★

I would like to see work of that sort done. I am quite sure that the trade associations for screw producers, would be glad to work with an organization such as the Wire Association in order to simplify temper specifications, for instance, or possibly to develop over-all specifications for non-ferrous wire, specifically for cold heading.

★ ★ ★

I think that the work can be done very readily, for the mutual benefit of both wire producers and their customers.

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Through the years our baby has had no name.

Through the years we have been content to say we make the best lacquer in the world for insulated wire. Our customers have always agreed and kept on ordering more lacquer—but still, the best lacquer in the world, our baby, remained nameless.

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It means that NELCO has grown up.

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It means that NELCO is proud to be known by its own name at last and will do its utmost to keep that name at the top.

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We have NELCO for vinyl insulated hook-up wire; NELCO for automotive high and low tension wire; NELCO for electrical tubing; and NELCO for aircraft low tension hook-up wire.

And all the time we're discovering new uses, new applications for NELCO.

This is a child to watch.

When your wire lacquering problems seem unsolvable, bring them around and let us introduce you to NELCO. The NELCO lacquers are specially tailored to overcome the most difficult problems and meet the most exacting standards.

NEW ENGLAND LACQUER CO.
150 King Philip Rd., East Providence, R. I.

Discussion on Precision Spring Design

(*Continued from page* 157)

tremely careful in designing calibrators properly.

★ ★ ★

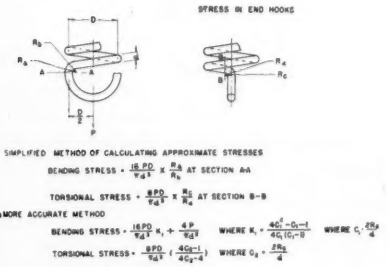
You will note that this calibrated spring, #4, is wound with initial tension. When we apply a half-pound load to this spring, all coils are free, and when we apply an additional 3-pound load the result is a 3″ deflection, the same as in the three preceding springs. This latter spring can be accurately calibrated quite easily to a few thousandths of an inch for this 3″ deflection, whereas it would be difficult to manufacture the #1 and #2 springs to a 2% tolerance on rate, which amounts to a .020″ tolerance on deflection, especially when the relationship between the end coils is important.

★ ★ ★

If the application does not indicate the type of end hooks to be used every endeavor should be made to specify the type of ends that would produce the most concentric loading and be the most economical to manufacture. Special attention should be given to the concentration of stress existing at the severe bends of hooks.

★ ★ ★

Many spring failures occur today with springs that are designed


STRESS IN END HOOKS
SIMPLIFIED METHOD OF CALCULATING APPROXIMATE STRESSES
BENDING STRESS = $\frac{16PD}{\pi d^3} \times \frac{R_A}{R_B}$ AT SECTION A-A
TORSIONAL STRESS = $\frac{8PD}{\pi d^3} \times \frac{R_C}{R_B}$ AT SECTION B-B
*MORE ACCURATE METHOD
BENDING STRESS = $\frac{16PD}{\pi d^3} K_1 + \frac{4P}{\pi d^2}$ WHERE $K_1 = \frac{4C_1^2 - C_1 - 1}{4C_1(C_1 - 1)}$ WHERE $C_1 = \frac{2R_B}{d}$
TORSIONAL STRESS = $\frac{8PD}{\pi d^3}\left(\frac{4C_2 - 1}{4C_2 - 4}\right)$ WHERE $C_2 = \frac{2R_C}{d}$

satisfactorily for stress in the body of the spring but fail at the ends where loads are applied, since stresses at the bends of the hooks exceed the safe stresses allowable. Hooks that are made with severe bends invariably fail because of stress concentration. A simple method of determining the stress in the body bend in a hook can be

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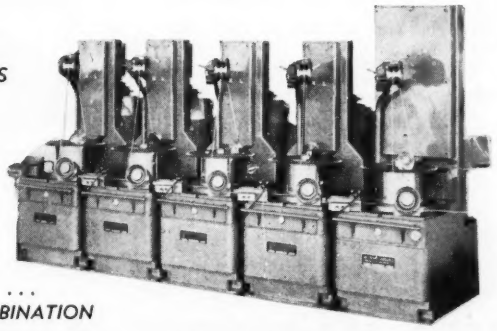

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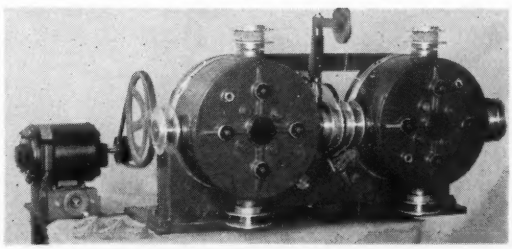

Winds short coils (25′ to 200′) continuously. Traverse wire with layer wind. When proper length is wound, guide is forced by solenoid action to opposing spindle turning at same speed. When sufficient turns are wound on second spindle—a knife jumps between heads and cuts wire connecting the two coils. The head with the full coil indexes upward and an empty coil comes into winding position. Operator then easily removes full coil and ties it as desired. Works particularly well with bell and stove pipe wire. Can be speeded for long coils—slowed for shorter. ½H.P. motor provides ample power. Operator requires no training, skill or experience.

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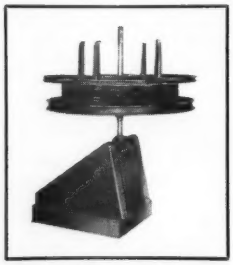

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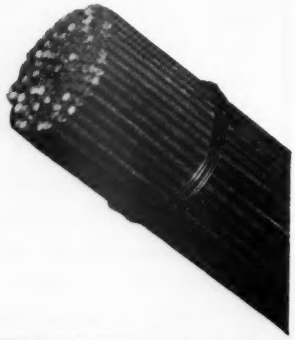

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found by multiplying the bending stress $\frac{16PD}{\pi d^3}$ at the helical section of the spring by the ratio $\frac{R_a}{R_b}$, where R_a equals the radius of the center line of the bend as shown, and R_b equals the inside radius of the curvature of the wire at the bend. The maximum bending stress obtained in this manner will always be on the safe side and usually only slightly higher than the true stress. Thus, the maximum bending stress can be calculated by the equation $S_b = \frac{16PD}{\pi d^3} \times \frac{R_a}{R_b}$.

★ ★ ★

To insure hooks operating at safe stresses it is also necessary to calculate the torsional stress that exists on the angular bend at section BB.

★ ★ ★

As before, a simplified method of calculating the torsional stress can be found by multiplying the torsional stress at the helical section of the spring by the ratio $\frac{R_c}{R_d}$, where R_d is the inside radius of the bend and R_c is the radius of the center line of the bend.

★ ★ ★

In other words, the torsional stress is calculated as follows:

$$S^T = \frac{8PD}{\pi d^3} \times \frac{R_c}{R_d}$$

★ ★ ★

As mentioned in calculation for bending stress, calculation of torsional stress with this simplified equation will give the stress on the high side.

VALUES OF STRESS CORRECTION COEFFICIENT - K_1

C_1	K_1
3.0	1.33
3.5	1.27
4.0	1.23
4.5	1.20
5.0	1.18
5.5	1.16
6.0	1.14
6.5	1.13
7.0	1.12
7.5	1.11
8.0	1.10

WHERE $K_1 = \frac{4C_1^2 - C_1 - 1}{4C_1(C_1 - 1)}$

$C_1 = \frac{2 \times \text{RADIUS OF CENTERLINE OF BEND}}{\text{WIRE DIAMETER}}$

★ ★ ★

We might point out that it is usually better to reduce the diameter of the end coil of extension springs to insure the hooks being stressed normally. By making the end coil smaller, the moment arm of the load is made smaller, likewise the stress. In most cases where springs are designed for stress in the upper limits, it is not recommended to have hook diameters that exceed the actual diameters of the helical section of the spring.

New Marker Tape for Cable Developed

A parallel thread (weftless) tape of Fiberglas yarns, with potential applications in many industries has been placed on the market by **R. I. Tapes, Inc.,** 409 Roosevelt Ave., Central Falls, R. I., whose engineers are said to be the first to have developed such tapes. According to the manufacturer, the glass tape is more economical than cotton, it will not stretch and it meets all requirements for heat resistance, water-proofing, water-repellency, fungus-resistance, and non-hygroscopic and non-fraying characteristics.

★ ★ ★

These glass tapes will take 350 pounds steam pressure and 310 Celsius heat. They can be produced in thicknesses as low as .004 inches and in widths ranging from 1/16 through 3/4 inches.

★ ★ ★

End uses of weftless Fiberglas tape suggested by the manufacturer are as marker tapes for the wire and cable industry; serial tape to replace the presently used cotton or paper tapes; reinforcing tape to replace jute, flax, sisal, nylon or treated paper; and binder tape on communication cable. It can be used under asphalt coating, in neoprene or rubber jackets and in weather-proof wire and cable; also in underwater cables and where high tensile strength is needed.

★ ★ ★

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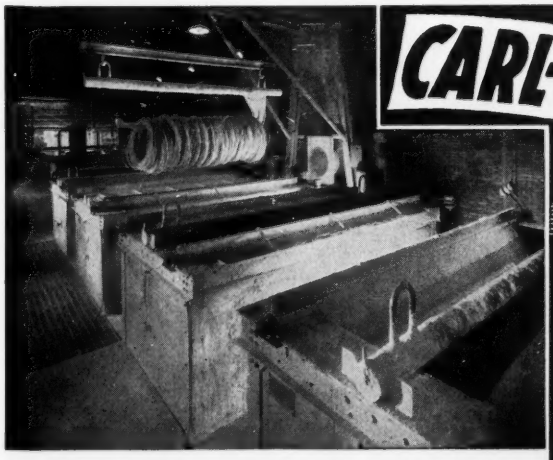

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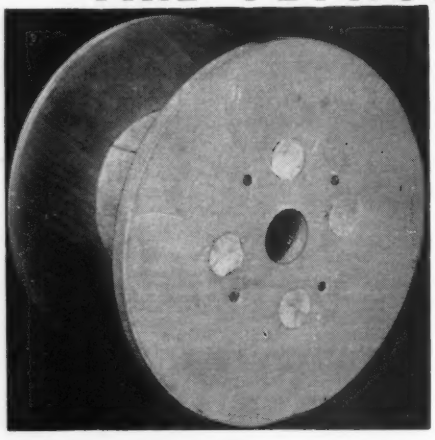

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National-Standard Offers New Bulletin on Copperply

Copperply, steel wire electroplated with copper, is the subject of a new bulletin just released by the **National-Standard Company,** Niles, Michigan. An informative feature of this bulletin is a comparison between the properties of Copperply wire and copper wire.

★ ★ ★

A recent National-Standard development, Copperply is available in a wide range of closely controlled tensile strengths and coating weights. Designed primarily for electrical applications, Copperply is finding new and cost-cutting uses wherever strength or stiffness, in addition to conductivity, is important.

★ ★ ★

Also included in the bulletin are charts showing comparative bending characteristics of 10% Copperply, commercial bronze, cadmium bronze and copper wire. Please write to the company asking for Bulletin 201.

Okonite Termed "Excellently Managed"

The Okonite Company, Passaic, N. J., has been certified as "excellently managed" by the American Institute of Management, New York.

★ ★ ★

According to **Jackson Martindell,** president of the Institute, only 348 companies in the United States and Canada, out of the 3,000 leading concerns whose methods were studied by that non-profit foundation, were found eligible to receive the designation for the year 1953.

★ ★ ★

The Institute uses a point system for rating ten key factors in each company—economic function, corporate structure, health of earnings growth, fairness to stockholders, directorate analysis, research and development, fiscal policies, production efficiency, sales vigor and executive evaluation.

Largest Instrument Exposition Planned

The First International Instrument Exposition, sponsored by the **Instrument Society of America,** will be held at the Philadelphia Convention Hall, September 15th -21st, 1954.

★ ★ ★

Over 70 technical sessions have been arranged by the Instrument Society of America, sponsor of the Congress and Exposition, and by the following cooperating Societies: **American Institute of Physics; American Society of Mechanical Engineers, Instruments & Regulators Division; American Microscopical Society; American Society of Photogrammetry; Society of Experimental Stress Analysis; American Institute of Chemical Engineers, Division of Chemical Processing Equipment and Instrumentation; American Institute of Electrical Engineers, Instruments and Measurements Committee; Institute of Radio Engineers, Professional Group on Instrumentation; Metropolital Micro-Chemical Society of New York, Analytical and Micro-Chemical Group,** Philadelphia Section, **American Chemical Society; Affiliated Group**

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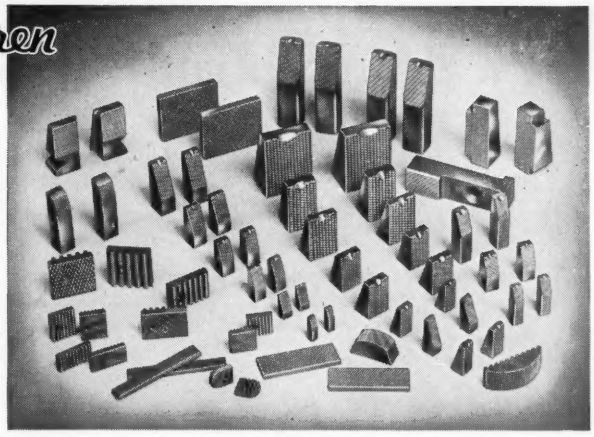
JAWS . . . .

for Wedge Grips, Pullers and Tensile Testing Machines of all makes are available either from stock or manufactured to order. A Sjogren jaw, made to meet your requirements, guarantees you service.



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SHEFFIELD manufacturers wire

Sheffield Manufacturers Wire is drawn from steel made from furnace to finished product in Sheffield's own mills. Quality is checked and guarded at every step. Perfect uniformity and accuracy of gauge are assured, for greatest efficiency in your operation.

Sheffield is prepared to serve your needs quickly for manufacturers wire in any quantity. Get in touch with your nearest Sheffield office.

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SHEFFIELD STEEL CORPORATION

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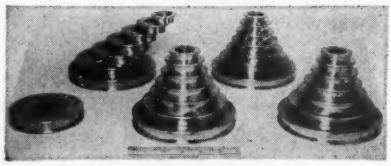
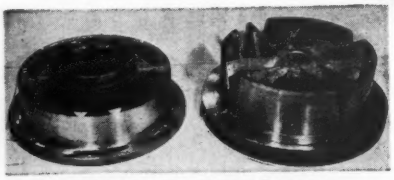


SYNCRO A-16 DRAW RINGS

Pictured at left and below are some wire drawing machine blocks. Many other parts can be hardsurfaced to advantage.

VAUGHN 20" BLOCKS



MORGAN-CONNOR 22" BLOCK

Parts last 3 to 10 times as long as standard equipment—Saves downtime — Cuts wire rejections — Increases production.

OTHER APPLICATIONS

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Sheaves and Pulleys
E T C.
Steel Crane Wheels
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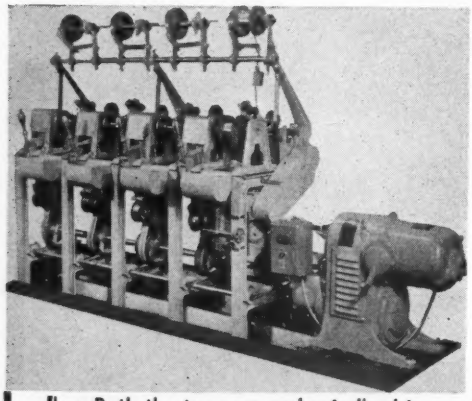
P.O. Box 504 Tel.: Metuchen 6-4747 Menlo Park, N. J.



1900-HV MULTIPLE SPINDLE SPOOLER

SPECIFICATIONS
Size Range: .010" to .080" or heavier if soft and many flat wire sizes.
Max. Spool Size: 16" flange diameter.
Capacity: usually 4 to 8 spindles.

The 1900-HV Spooler is a rigid, precision machine which will consistently produce a uniform, dense wire lay. Both the traverse and spindle drives are regulated through wide-range, stepless, variable speed units, eliminating change gears. The 1900-HV is completely adaptable to your particular constant or changing demands. All controls are positive. Adjustments are made accurately with the spooler in operation and without tools.

Both smooth acceleration and rapid stopping is obtained through a single lever at each station. Spool changing is simple and rapid. Anti-friction bearings are used on all shafting and spindles.

Your special requirements can be incorporated into the design. Each machine is delivered ready for operation from your power supply. Payoff stands furnished as extras.

Consult us on your spooling problems.

ROBERT J. EMORY COMPANY

31 East Runyon Street Newark 5, N. J.

of Analytical Chemists, Delaware Section, **American Chemical Society;** South Jersey Section, American Chemical Society.

★ ★ ★

Further information may be obtained by writing the Managing Director, First International Instrument Congress and Exposition, 845 Ridge Avenue, Pittsburgh 12, Pennsylvania, USA.

Patent Issued on Aluminum-to-Steel Fastener

A new patent covering the **"NELWELD"** aluminum and mild steel composite rivweld stud used for fastening aluminum siding and roofing to structural steel has been issued to the **Nelson Stud Welding Division of Gregory Industries, Inc.,** Lorain, Ohio, by the U. S. Patent Office (Patent No. 2663270).

★ ★ ★

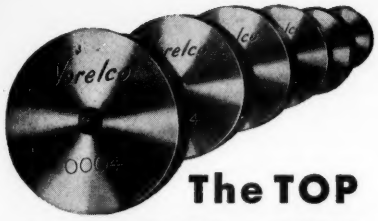
The granular fluxed mild steel end of the stud is end-welded in a split second to the steel purlins or girts with the Nelson stud welding gun. The aluminum siding or roofing is impaled over the aluminum end of the stud which is then riveted, holding the aluminum sheet away from the steel purlin and eliminating detrimental electrolytic action.

★ ★ ★

If you are interested in further information on this product, please write to the company.

Alloy Metal Wire Issues Technical Data

Alloy Metal Wire Company, division of H. K. Porter Company, Inc., of Prospect Park, Pa., has issued a comprehensive brochure on its products. The different nickel alloys are listed by chemical content. Technical data concerning the composition of the various alloys, as combined with copper, manganese, aluminum, etc., is given, together with the properties and functions for which each alloy is suited. This includes the properties of strength, ductility, toughness, corrosion resistance, mechanical properties, heat resistance,



The TOP
DIAMOND DIES
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For your most exacting wire drawing requirements, standardize on NORELCO Diamond Dies, made by the master craftsmen of PHILIPS in the world's largest, most modern diamond die factory.

Only the very best South African and Brazilian diamonds are used. Each consists of one closed crystal. Less than .4% of all the diamonds mined meet PHILIPS high quality requirements for purity, structure and shape.

These diamonds are drilled to precision tolerances, varying in proportion to the diameter, normally 0.3 to 3.5 microns. Closer tolerances can be supplied, if required.

Let us quote on your diamond die requirements.

North American Philips Company, Inc.
Elmet Division, Lewiston, Maine

Norelco

Note below the highly polished precision shaped drawing channel of this die for drawing copper which gives a burnished finish to the wire and long life to the die.

spring properties, and magnetostrictive properties. Tensile strength and design stress are also analyzed. The comparative advantages and disadvantages of the different alloys is studied, as related to savings in material, savings in labor and production time, and methods of production.

★ ★ ★

Of particular interest is an illustrated list of various standard fastenings, including nuts, bolts, screws, nails, rivets, bearings, etc., made from the different nickel alloys. Many illustrations are given of electronic specialties, consumer products, and industrial products manufactured from the various nickel alloys.

Introduces New Feature in Insect Screening

A new reinforced edge that supplies extra strength, greater ease of handling and longer wear has been developed and announced by **Wickwire Brother, Inc.,** Cortland, N. Y. Called "Multi-Wire Edge," it is composed of five extra strands of wire running along the outside holding edge.

★ ★ ★

Cortland Gray-Wick Screening with Multi-Wire Edge lies flat when unrolled and is easier to cut, handle and install. The new edge also adds strength and rigidity to the screening, making it superstrong along the vital tacking surface.

★ ★ ★

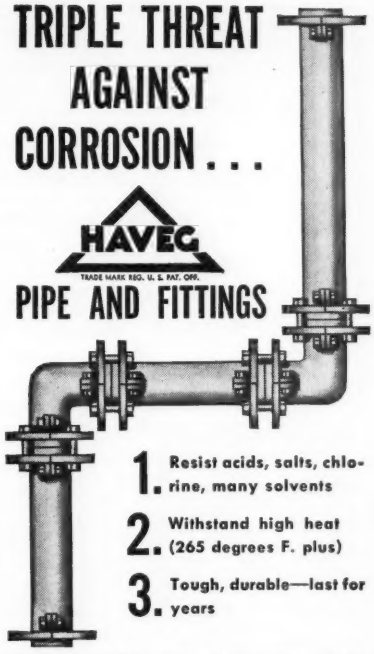
Samples of Cortland Gray-Wick Screening with the new Multi-Wire Edge may be obtained by writing Wickwire Brothers, Inc., Cortland, N. Y.

New Resin Cement Developed

The Atlas Mineral Products Co. announces that, as a result of three years of research, it has developed a resin cement with improved workability which is resistant to all alkalies, detergents, greases, solvents, oils, salts and non-oxidizing acids. This product, which is non-toxic to the applicator, can be applied at a rate approximately 50% faster than any resin cement available previously.

TRIPLE THREAT AGAINST CORROSION . . .

HAVEG
TRADE MARK REG. U. S. PAT. OFF.
PIPE AND FITTINGS



1. Resist acids, salts, chlorine, many solvents
2. Withstand high heat (265 degrees F. plus)
3. Tough, durable—last for years

Beat the high cost of corrosion with proven, genuine Haveg pipe and fittings. Pipe highly corrosive fluids in temperatures as high as 265 degrees F. with a good margin of safety! Since Haveg is not a coating or lining, the possibility of contamination is eliminated.

Haveg is a moldable, thermosetting plastic made by mixing acid-digested asbestos with special resins. Haveg process equipment is unusually resistant to most acids, salts, chlorine, many solvents . . . and withstands extremely high thermal shock. Haveg is really a triple threat against corrosion!

Send for 64-page Bulletin F-6. It contains complete information on Haveg pipe, fittings, valves, pumps, cylindrical and rectangular tanks, heat exchangers, and other corrosion-resistant process equipment. Call your Haveg sales engineer for first-hand facts.

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WIRE CLOTH WEAVING

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Up to the finest mesh in bronze and stainless steel.

Write for details

GANTOIS

SAINT-DIE (VOSGES) FRANCE

More Powerful Transistors

Minneapolis-Honeywell Regulator Co. has developed a power-type transistor in its research laboratories claimed to be 100 times more powerful than present commercial types.

★ ★ ★

The new unit, about the size of a small thimble, has an output of 20 watts, compared with that of 20 hundredths of a watt in other types now available, reported **Dr. Finn J. Larsen,** research director. The transistor is a smaller, less costly replacement for the vacuum tube in many electronic applications.

★ ★ ★

Dr. Larsen thinks the added power will extend the use of transistors into the field of automatic controls, the operation of motors, valves, relays and other equipment not now feasible. "The inability of transistors to handle sizable amounts of current has been a major drawback," he says.

★ ★ ★

The new transistor is not yet in commercial production, but is being built on a pilot line basis.

Wire Reinforced Plywood Reported Being Developed

A wire-reinforced plywood that proponents claim may offer double the structural strength of standard plywood is being developed.

★ ★ ★

The process is hush-hush and the Douglas Fir Plywood Association won't say yes or no when asked about reports that samples have been received for testing.

★ ★ ★

Roy E. Gilmore, of Portland, Ore., is the inventor. He calls his wood-and-metal sandwich "Gilwood." **Colorado Fuel & Iron Corp.** has been working with him to perfect manufacturing processes, and is already turning out experimental batches of the wire mesh required—most of it from its Calwico Division mill at Oakland, Calif.

★ ★ ★

The strength-giving element is a black iron woven mesh cloth. It's made much like the common window screen, but of heavier wire (23½ gauge), with sixteen to the square inch. This mesh is glued between two of the sheets of veneer that make up plywood.

★ ★ ★

Commercial production is still not assured. The inventor asserts he is negotiating with three firms, two of them outside the plywood industry. Some of the men in the industry remain skeptical, emphasizing that the reinforced plywood hasn't been tested under rigorous, long-term usage. They question whether the glue bond would prove as strong as in ordinary panels.

★ ★ ★

Mr. Gilmore thinks consumers will have little trouble sawing through both the metal and the wood of the new material. Most building carpenters, he contends, use carbide-tipped blades on their power saws, and most of these operate fast enough to cut "Gilwood" satisfactorily.

★ ★ ★

Mr. Gilmore's own figures on some of the tests conducted show standard quarter-inch panels breaking down under 1,140 pounds pressure per square inch, while reinforced panels of the same thickness held up beyond 4,000 pounds.

★ ★ ★

He believes a wire-reinforced plywood panel three-eighths of an inch thick could do the same job for builders and others as an ordinary piece of plywood double that thick. This would cut material costs. And for consumers distant from the plywood mills freight charges would be lower.

New Disposable Paper Work Caps

A disposable paper work cap developed by Du Pont's safety engineers for use in one of the company's large chemical plants is now available from **Record Industrial Co.**, 3301 Arch St., Philadelphia 4, Pa. The caps, made of heavy Kraft paper which has been

MUSIC WIRE and SPECIAL WIRES

Music Wire for Industrial Purposes
211 sizes Bright Polished, .0015" to .3125"
45 sizes Bright Tinned, .003" to .125"
Aluminum—Annealed—Belt Lacing—Brass, Soft and Spring—Copper, Bare and Tinned
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in an Envelope—Florist Wire—Spooled and Coiled, ¼-½-1-5#
Wires Straightened and Cut to length—Small Gauges—Small orders our specialty
Wires and Strands for the fishermen. Trolling Wires, Copper-Monel-Stainless.
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Round for Kel-F & Teflon Insulated Radio and Instrument Hook-up Wire and UHF Cables.
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NEVA-TARN—Metallic Yarns—Tarnish proof—for knitted and woven fabrics. Est. 1871

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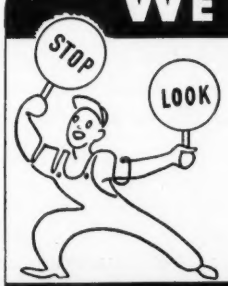

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JOHN G. ARCHER
Fourth and Grand
West Des Moines, Ia.

treated with neoprene rubber, were adopted by Du Pont after exhaustive service trials under severe plant conditions.

★ ★ ★

The supply firm now handling these caps originally worked with Du Pont plant people in designing the headpiece. Du Pont has reserved no rights so far as manufacture and sale of the caps are concerned.

★ ★ ★

A prime advantage is economy. They sell for about a third less than cloth caps, are water repellent and come pre-treated with a flame retardant. While it is lighter in weight, the paper cap is surprisingly substantial and holds its shape well.

New Furnace and Oven Control Catalog

A new, greatly expanded catalog of complete control systems for Furnaces, Ovens, Dryers and Kilns has just been announced by **The Bristol Company**, Waterbury, Conn. The new book contains all the detailed engineering specification and prices necessary to choose and order the proper control "package" for a particular installation.

★ ★ ★

Essential accessories, such as charts, scales, thermocouples, bulbs and tubing, switches, panels and combustion safeguards are included to complete the list of requirements for any type of electric or fuel-fired heating application.

★ ★ ★

Copies are available from The Bristol Company, Waterbury, Conn.

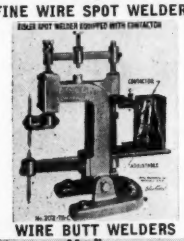
New Hydraulic Guillotine For Steel and Aluminum Rod

A 1¼" diameter steel rod can be cut in 3½ seconds with the new Manco Hydraulic Guillotine model 21. The unit, which also can cut aluminum rod to 1⅝" diameter, is designed for use in cutting and trimming coiled rod stock; for cutting on the draw bench; test cuts

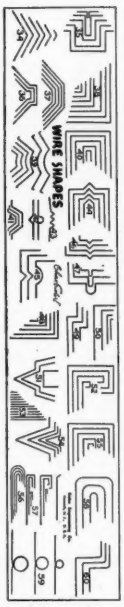
For FINE WIRES from .001" to 1/16"

High Speed Wire Cutters and Benders. Wire Spot Welders and Wire Butt Welders. Ask for test samples. Established 1920.

FINE WIRE SPOT WELDERS

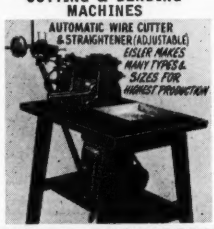


Indexing Turntables
Cam Milling Service



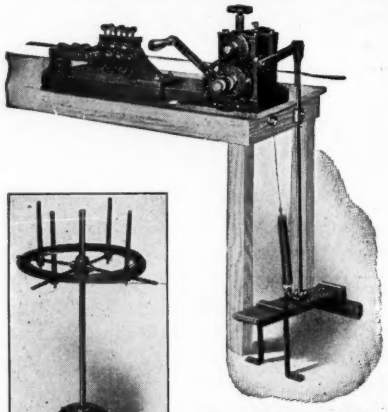
WIRE BUTT WELDERS

CUTTING & BENDING MACHINES



EISLER ENGINEERING CO., Inc.
747 So. 13th St., Newark 3, N. J., U. S. A.

WIRE STRAIGHTENER



The Kilmer Wire straightening and cutting machine is hand operated and recommended for wire No. 8 to No. 19 gauge.
Wire Reel will handle coils up to 150 lbs. with I.D. adjustments from 7" to 22" and 30" O.D.

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METAL BOUND RETURNABLE REELS

Made in 12" to 24" diameters.

No nails used. *All glued construction.* Made of kiln-dried wood. Special design prevents breaking or splintering of wood, protecting insulated wire from damage.

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NATIONAL OFFERS YOU THREE SERVICES

- DIAMOND POWDER RECLAMATION — Exclusive process that gives maximum recovery. Send us your old cotton, die washings, worn wheels and sludge. High salvage percentages will pay you well.
- DIAMOND POWDERS—Complete line of graded quality powders for all lapping and finishing operations on wire drawing dies. First grades only.
- DIAMOND GRINDING WHEELS—A complete line of top-quality wheels for industrial production.

Write for prices.

NATIONAL RESEARCH COMPANY
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for piping and for cutting cobbles in aluminum mills.

★ ★ ★

The unit can be obtained dolly-mounted for mobility with the cutting head suspended by a spring tension balancer. The cutting head weight is 150 lbs., with total weight of the unit including carriage being 921 lbs. Fifty tons cutting thrust is supplied through the hydraulic pump powered by a 2 h. p. electric motor. A manual control lever actuates the unit without the necessity of solenoid switches.

★ ★ ★

Complete information may be obtained by writing to the Manco Manufacturing Company, Bradley, Illinois.

Knapp Company Moves to Larger Plant

To meet increased production demands and to improve manufacturing facilities, the **James H. Knapp Company,** the West Coast's oldest and largest designer and manufacturer of industrial furnaces, has moved into its new plant at 1731 Workman Street, Los Angeles 31. The announcement was made by **Harry L. Oppenheimer,** president.

★ ★ ★

Some 151,000 square feet of the new location will be used immediately in the expansion by the company, whose specialized industrial furnaces and melting equipment is known the world over. Four modern concrete and steel buildings, housing the shops, and engineering and administrative offices, cover approximately half the space, with the remainder used for paved, steel-fenced fabrication yards. Machine shops and assembly areas are outfitted with the latest steel-handling and fabricating equipment, and the entire three and a half acre plant is served by heavy-duty overhead cranes. Two six-car railroad spurs, and large truck yards provide ample freight-handling facilities.

★ ★ ★

Knapp manufactures the Knapp-Lee Quick Quench Aluminum Heat Treat Furnace, a general line of

MASON STYLE
NON-RETURNABLE
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STANDARD 5", 6½" x 10½" DIA. SPOOLS TO MEET ALL RIGID NON-RETURNABLE REQUIREMENTS

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MASON CAN COMPANY OF OHIO
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HANDKLIP
6C WIRE CUTTER

For FREE CUTTING of wires, cable, rods, baling wire and bolts up to medium hardness.

One of the handiest, most useful cutters ever made. Parrot-beak jaw quickly locates material for easy cutting. Protruding tip of jaw prevents wire from slipping, aids in stretching wire and is great for pulling out staples.

Essential equipment for cutting high tensile communication and power wires used in rural electrification (Model 6B with special hard cutting edges). See your supplier.

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PORTER FERGUSON Autobody and Fender Repair Tools

Time to Discard

OLD-FASHIONED WAYS

Jacks . . props . . shores . . horses . . why fool with these obsolete methods of handling reels? DO IT THE MODERN, EFFICIENT WAY! Reel or unreel wire, cable, rope with

ROLL-A-REEL

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Welded Wire Fabric Used In Runway Paving at Airport

The first known use of welded wire fabric in asphalt runway topping has been made at the Indianapolis Airport. Application of the fabric was unique in that it was rolled out along the transverse expansion joints between slabs of the existing Portland cement concrete runway. Welded wire fabric is usually laid in sheets, longitudinally in the direction of the paver.

★ ★ ★

Over 2,500 feet of the heavily used main runway were resurfaced, with welded wire fabric going over most of the existing expansion joints. For purposes of later comparison, however, the fabric was omitted from some joints.

★ ★ ★

After the preliminary preparation of the base, the first course, one and a quarter inches thick, of coated aggregates, heated to a 180 to 240 degree range, was laid down and rolled over the entire width of the runway for the length of the project.

★ ★ ★

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Next, the fabric, of number 10 gauge wire spaced three inches longitudinally and six inches transversely in 100 foot rolls, five feet wide, was placed over the now covered expansion joints with a two-foot clearance on either side of the 104-foot runway. Wire staples were used to hold the fabric in place at the start of each roll, with only enough fabric unrolled for a single pass of the paver. As each succeeding pass was made, more fabric was unrolled, and shovelfuls of asphalt thrown onto the fabric.

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Data and results of other resurfacing projects using welded wire fabric in asphaltic concrete can be obtained from the Wire Reinforcement Institute, Inc., National Press Building, Washington, D. C.

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The use of "Sprabond" a pure molybdenum wire for metallizing use—has expanded rapidly since its introduction about four years ago. At that time it was recommended primarily as a bonding coat material which simplified and speeded surface preparation for most normal metallizing applications. It permitted the development of extremely high strength bonds for special purposes.

★ ★ ★

Since the introduction of Sprabond, however, continuing investigations in the laboratory, as well as many actual applications by metallizing users, have indicated other possibilities for this material, particularly for product designers, in product improvement, simplified manufacture and lowered costs.

★ ★ ★

Applications involving the use of this metallizing material for building up wearing surfaces have expanded rapidly. Sprabond has shown phenomenal resistance to wear when running against bronzes and the life of the bronze mating surfaces is greatly increased. Applications involving babbitt or other white metal bearings are in service and have also given evidence of unusual performance.

★ ★ ★

Another very promising field for Sprabond wire surfacing is in abrasive wear where shock or impact is not excessive. Examples of possible applications along these lines are with forming dies, mandrels, or pulleys running under abrasive conditions. Since Sprabond deposits bond perfectly to most aluminum and magnesium alloys, the advantages of a high strength/ weight ratio for high speed rolls, pulleys, etc., may be gained by making such parts of light alloys and providing critical

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★ ★ ★

Many applications are described and illustrated in Bulletin 57C. Write for a copy to METALLIZING ENGINEERING CO., INC., 38-14 30th Street, Long Island City 1, N. Y.

Scientist Honored on 80th Birthday

A world-famous scientist whose discoveries have given to society the modern lamp bulb, X-ray tube and other electronic tubes, the art of powder metallurgy, and industrial cutting tools, was honored on his 80th birthday on October 20th in Cleveland by more than 100 friends and associates.

★ ★ ★

He is **Dr. William D. Coolidge,** of Schenectady, N. Y., former vice president and director of research for the **General Electric Company.** Dr. Coolidge is noted chiefly for his discovery in 1908 of a means of making a tough metal, tungsten, into an extremely pliable one which could be drawn into wire one-sixteenth the diameter of a human hair.

★ ★ ★

As of the present, he has received 83 patents for his inventions, and has been the recipient of most of the awards, honors and degrees the world can give a distinguished scientist.

★ ★ ★

Despite his 80 years, Dr. Coolidge remains active and has many interests. He is director emeritus of the G-E Research Laboratory, and serves as X-ray consultant. He and his wife recently returned from a 3000-mile motor safari through central Africa from Capetown to Addis Abbaba.

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New Self-Leveling Mountains Give Heavy Machines Run of The Plant

Installing and leveling heavy machinery in minutes—without bolting or shims—is now possible with the new series LM3 and LM5 Barrymounts.

★ ★ ★

The latest **Barry Corporation** vibration isolators are giving industrial plants much-needed mobility of machine tools. These new Barrymounts lift a machine foot to the required height for leveling by a simple turn of the attaching bolt. To manufacturers in a score of industries, the isolators provide:

★ ★ ★

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★ ★ ★

Write to Barry Corporation, 1000 Pleasant St., Watertown, Mass., for further details.

Officials of ACP Assess Values Of Their International Meeting

Officials of **American Chemical Paint Company** are evaluating the results of an international convention which brought together chemical manufacturers of 42 nations at the firm's plant in Ambler, Pa., and in Washington, D. C., in October.

★ ★ ★

The convention was unique of its kind, bringing together as it did U. S. Government officials, college experts and so many representatives of private industry in foreign countries.

★ ★ ★

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ists, use ACP trademarks, formulas, experience and facilities as licensees under know-how contracts, but the Pennsylvania firm has no direct financial interest in its overseas associates.

★ ★ ★

Company and university experts addressed the delegates for four days in Ambler. U. S. Government officials talked with them for two days in Washington, D. C.

New Hand Tachometer Announced

Confusion and reading errors are minimized, when measuring speeds with the new Metron Hand Tachometer, by a novel thumb operated range selector which automatically changes the scale numbers for each range. The same mechanism also brings into view the correct number of R.P.M. per scale division, eliminating the need to "figure out" the scale markings for each range. The extra long scale is sub-divided for maximum readability. Other outstanding features include: sustained high accuracy; long life; low operating torque; rapid response; permanent lubrication; and rugged but light weight construction.

★ ★ ★

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★ ★ ★

For detalis regarding this or other Tachometers, please write to the Metron Instrument Co., 432 Lincoln St., Denver 3, Colo.

X-Ray Apparatus Exhibited by Westinghouse

Two pieces of x-ray apparatus were exhibited, one introducing a new era in internal inspection and the other illustrating how x-ray inspection can be employed in the

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production line, at the Metal Exposition in Cleveland:

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★ ★ ★

Examples of other x-ray equipment were shown on the booth's backdrop.

Spencer Wire Announces Election of Officers New Warehouse Completed

The appointment of the following new officers, for the **Spencer Wire Corporation,** Union, N. J., were announced recently by **Bernard Aronson,** President. **Lloyd W. Simpson,** formerly Works Manager, now becomes Vice President, **James M. Hall** has been made Treasurer; and **Clifford G. Weber** has been appointed Asst. Secretary. All of these men have been with the company since its inception.

★ ★ ★

At the same time the president announced the appointment of **Leonard O. Walde** as Copper Consultant to the company and William E. Leonard, who formerly managed their Brookfield plant, as Steel Wire Consultant. Mr. Walde spent over 25 years with the Anaconda Copper Company and its subsidiaries and is well-known throughout the wire industry. Mr. Leonard, prior to joining the company, spent many years in various capacities for American Steel and Wire in Worcester.

★ ★ ★

Mr. Aronson has also advised of the completion of a new 35,000 sq. ft. warehouse adjoining the company's Cabling Plant in Union, where stocks of all sizes of bare and weatherproof wire and cable will be carried to provide prompt deliveries and to make large inventories of copper wire unnecessary on the part of their customers.

J.&L. Executive Changes

A. T. Lawson, vice president-general services, was named vice president-production at **Jones & Laughlin Steel Corp.,** Pittsburgh, and elected to the board of directors and the executive committee.

★ ★ ★

He succeeds **E. K. Miller,** now acting as consultant. **Herbert Johnson,** vice president-administration, is now vice president-general services. Other changes include **Walter H. Lewis** appointed works manager, Pittsburgh Works division, **William P. Getty** named assistant vice president-production and **Frank Cambest** assistant to the vice president-production.

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WHERE TO BUY

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.
Only advertisers who have contracted for six or more insertions are listed in this section.

ABRASIVES—
Elgin National Watch Co., Abrasive Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Norton Co., Worcester, Mass.

ACID INHIBITORS—
(See Inhibitors, Pickling)

ACID-PROOF CONSTRUCTION—
Ceilcote Company, Cleveland, Ohio
Chemical Construction Co., Pittsburgh, Pa.
Haveg Corporation, Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio

ANNEALING MACHINES — Electric Resistance
Synerc Machine Co., Perth Amboy, N. J.
Trauwood Engr. Co., Cleveland, O.

ANNEALING POTS AND BOXES—
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.

BAKERS—(See OVENS—Rod Bakers)

BOBBINS—Braider & Wire Weaving
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

BORAX—Wire Drawing
Pacific Coast Borax Co., New York, N. Y.

BORON CARBIDE—
Norton Co., Worcester, Mass.

BRAKES—Pneumatic
Entwistle, Jas. L. Co., Providence, R. I.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket. R. I.

CASTINGS—Wire Mill
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.

CEMENTS—Acid Proof
Ceilcote Company, Cleveland, Ohio

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CLEANERS—Metal
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Phila., Pa.
Metal & Thermit Corp., New York, N. Y.
Parkin Chemical Co., The, Pittsburgh, Pa.
Standard Industrial Compounds Co., Chicago.

CLEANING & PICKLING EQUIP.—
Ceilcote Company, Cleveland, Ohio
Chemsteel Construction Co., Pittsburgh, Pa.
Cleveland Tramrail Div., of the Cleveland Crane & Engineering Co., Wickliffe, O.
Haveg Corporation, Newark, Del.
Holden, A. F., Company, The, Detroit, Mich.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio
Youngstown Welding & Eng'g Co., Youngstown, Ohio.

CLOTH—WIRE, All Metals
Chase Brass & Copper Co., Waterbury, Conn.
Gantois, Saint Die (Vosges), France.
Roebling's, John A., Sons Corp., Trenton, N. J.
Wickwire Bros., Cortland, N. Y.

COATING COMPOUNDS—
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y
Standard Industrial Compounds Co., Chicago

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa.
Miller, R. H. Co., Inc., Homer, N. Y.

COMPOUNDS—Diamond (Pre-Mixed)
Eastern Carbide Corp., New Rochelle, N. Y.
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago.

COMPOUNDS—Extrusion, for Wire
(See Compounds—Vinyl)

COMPOUNDS—For Improving Drawing and Extrusion
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Metal & Thermit Corp., New York, N. Y.

COMPOUNDS—Phosphate Coating
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.
American Lanolin Corporation, Lawrence, Mass.
Apex Alkali Products Co., Philadelphia, Pa.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Standard Industrial Compounds Co., Chicago.

COMPOUNDS—Vinyl, for Wire
Electronic Rubber Co., Stamford, Conn.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Miller, R. H. Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison, N. J.
Pacific Coast Borax Co., New York, N. Y.
Standard Industrial Compounds Co., Chicago.
Swift & Company, Chicago, Ill.

CONDUCTORS—Flexible, Electrical
Montgomery Co., The, Windsor Locks, Conn.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire & Textile Mach'y, Inc. (used) Pawtucket. R. I.

CORDS—Electrical, Tinsel Conductor
Montgomery Co., The, Windsor Locks, Conn.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., Waukegan, Ill.
Willey's Carbide Tool Co., Detroit, Mich.

CUTTING TOOLS—Wire
Porter, H. K. Inc., Somerville, Mass.

DESCALING PROCESS—Sodium Hydride
du Pont de Nemours & Co., Inc., E. I., Wilmington, Del.

DIAMONDS—Industrial
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDERS—
Danforth, The C. W. Co., Youngstown, Ohio
Elgin National Watch Co., Abrasive Div., Elgin. Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
Industrial Diamond Powders, New Kensington, Pa.
National Research Company, St. Clair Shores, Mich.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDER RECLAIMING—
Boulin, Victor J., Inc., New York, N. Y.
Danforth, The C. W. Co., Youngstown, Ohio
Industrial Diamond Powders, Inc., New Kensington, Pa.
National Research Co., St. Clair Shores, Mich.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DIAMOND TOOLS—
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio
Nord International Corp., Montclair, N. J.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Carbide, Tungsten & Tantalum
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Cold Heading
Carboloy Dept. of General Electric Co., Detroit
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio
Vascoloy-Ramet Corp., Waukegan, Ill.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Diamond
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Cochaud Wire Die Inc., New York, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
North American Philips Co., Inc., Elmet Div., Lewiston, Me.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Extrusion
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Eyelet
Eastern Carbide Corp., New Rochelle, N. Y.
Kelly Wire Die Corp., New York, N. Y.

DIES—Nail, Nail Cutters, Feeder Blocks, Grippers, etc.
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc, New York, N. Y.
Carboloy Dept. of General Electric Co., Detroit.
Cochaud Wire Die Corp., New York, N. Y.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Ft. Wayne Wire Die., Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
New England Wire Die Co., Worcester, Mass.
North American Philips Co., Inc., Elmet Div., Lewiston, Me.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wayne Wire Die Co., Hillside, N. J.

DIES—Special Shapes, Etc.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Swaging
Sjogren Tool and Mach. Co., Inc., Auburn, Mass.

DIES—Tube Drawing
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., Waukegan, Ill.
Willey's Carbide Tool Co., Detroit, Mich.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRUMS & TRAVERSES—For Cable Reels
Entwistle, Jas. L. Co., Providence, R. I.
Hubbard Spool Co., Garrett, Ind.
New York Engineering Co., Yonkers, N. Y.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio

DRYING EQUIPMENT
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio.
Rockwell, W. S. Co., Fairfield, Conn.

ENGINEERS—Consulting
Lubricants—Hans C. Bick, Inc., Reading, Pa.
Wire Mill—Clarence S. Arms, Worcester, Mass.
Zinc—Imhoff, Wallace G., Co., No. Highlands, Calif.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FENCING & FENCES—Wire
Interlocking Fence Co., Morton, Ill.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio
Harper Electric Furnace Corp., Buffalo, N. Y.
Lepel High Frequency Laboratories, Inc., New York, N. Y.
Rockwell, W. S. Co., Fairfield, Conn.
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

FURNACES—Galvanizing Equipment
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Holden, A. F. Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Trauwood Engineering Co., The, Cleveland, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

FURNACES—Heat Treating
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., The, Detroit, Mich.
Lepel High Frequency Laboratories, Inc., New York, N. Y.
Morrison, John R., Industries, Inc., Cleveland, Ohio
Rockwell, W. S., Co., Fairfield, Conn.
Spring Mfgs. Supply Co., Plainville, Conn.
Surface Combustion Corp., Toledo, Ohio
Trauwood Engr. Co., Cleveland, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Induction
Lepel High Frequency Laboratories, Inc., New York, N. Y.

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

FURNACES—Pot (oil, gas, electric)
Ajax Electric Co., Inc., Philadelphia, Pa.
Holden, A. F., Co., The, Detroit, Mich.
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

FURNACES—Resistance Heating, Strand
(See Annealing Machines)

FURNACES—Salt Bath
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

GALVANIZING EQUIPMENT — (See MACHINERY—Galvanizing Wire)

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

GUIDES—for Wire
Heany Industrial Ceramic Corp., New Haven, Conn.

GUIDE TIPS—For Extruding Machines (See NOZZLES)

HAMMERS—Nail Heading
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Auburn, Mass.

HOOKS—Pickling & Liming
Youngstown Welding & Eng'g Co., Youngstown, Ohio

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

INSULATING MATERIALS—
Celanese Corporation of America, New York, N. Y.
Electronic Rubber Co., Stamford, Conn.
Glass Fibers, Inc., Toledo, Ohio
Heineman Corp., Oscar, Chicago, Ill.
Merrimac Paper Co., New York, N. Y.
Naugatuck Chemical Division of United States Rubber, Naugatuck, Conn.
New England Lacquer Co., E. Providence, R. I.

INSULATING MATERIALS — Paper—For Electric Wire Cable
Merrimac Paper Co., New York, N. Y.

LACQUERING SYSTEMS — See MACH.—Lacquering Electric Wire

LACQUERS—For Electric Wire
New England Lacquer Co., E. Providence, R. I.

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LIME—
Warner Co., Philadelphia and Bellefonte, Pa.

LUBRICANTS — For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison, N. J.
Standard Industrial Compounds Co., Chicago.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Swift & Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire, Hose)
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Barbed Wire
Glader Machine Works, Chicago, Ill.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany
Wean Engineering Co., Cleveland, Ohio

MACHINERY—Bolts & Rivets
Meyer, Roth & Pastor Maschinenfabrik (Cosa Corporation, New York, N. Y.), Koln-Raderberg, Germany

MACHINERY—Braiding
Fidelity Machine Co., Inc., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Wardwell Braiding Mach. Co., Central Falls, R.I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bunching
Cook Manufacturing Co., The, Paterson, N. J.
Federal Manufacturing Co., Wallingford, Conn.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Inc., Philadelphia, Pa.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
New York Engineering Co., Yonkers, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Capstans (See Machinery—Winding Wire)

MACHINERY—Chain Making
Meyer, Roth & Pastor Maschinenfabrik (Cosa Corporation, New York, N. Y.), Koln-Raderberg, Germany
Nilson, A. H. Machine Co., Bridgeport, Conn.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany

MACHINERY—Closing Rope
Watson Machine Co., Paterson, N. J.

MACHINERY—Coiling Rod
Vaughn Mach'y Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Cold Heading
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Copper Wire Drawing
Aetna-Standard Engineering Co., Pittsburgh.
American Insulating Mach'y Co., Phila., Pa.
National Mach'y Exch. (Used), New York.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)

MACHINERY—Cutting
Eisler Engineering Co., Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool, Inc., New Haven, Conn.
Wean Equipment Corp., Cleveland, Ohio
Wells, Frank L., Co., Kenosha, Wis.

MACHINERY—Descaling Rod, Dry
Fisher Associates, New York, N. Y.

MACHINERY—Diameter Testing Continuous
Standard Electronic Research Corp., New York, N. Y.

MACHINERY—Die Making
Boulin, Victor J., Inc., New York, N. Y.
Carboloy Dept. General Electric Co., Detroit, Mich.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Firth Sterling, Inc., Pittsburgh, Pa.
Kelly Wire Die Corp., New York, N. Y.
Nord International Corp., Montclair, N. J.
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Dry Blending, Plastics
Robinson Manufacturing Co., New York, N. Y.

MACHINERY—Edging (See MACHINERY — Tandem Rolling and Edging Mills)

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Industrial Ovens, Inc., Cleveland, Ohio
Rockwell Co., W. S., Fairfield, Conn.

MACHINERY—Extruding
Aetna-Standard Engineering Co., Pittsburgh.
Davis-Standard Sales Corp., Mystic, Conn.
Entwistle Co., J. L., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Interlocking Fence Co., Morton, Ill.
Malmedie Maschinenfabrik, Dusseldorf, Germany
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Filament Coil Winding
Eisler Engineering Co., Newark, N. J.

MACHINERY—Flat Wire
Mettler Machine Tool, Inc., New Haven, Conn.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp. Cleveland, Ohio

MACHINERY—Forming Wire
Baird Machine Co., Stratford, Conn.
Nilson, A. H., Machine Co., Bridgeport, Conn.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany

MACHINERY—Galvanizing Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle, Jas. L. Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating Wire
Aetna-Standard Engineering Co., Pittsburgh, Pa.
American Insulating Mach'y Co., Phila., Pa.
Davis-Standard Sales Corp., Mystic, Conn.
Ets. Pourtier Frères, Romainville, France
Fidelity Machine Co., Inc., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Mach. Co., Central Falls, R.I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Knitting
Fidelity Machine Co., Inc., Philadelphia, Pa.

MACHINERY—Lacquering Electric Wire
American Insulating Mach'y Co., Philadelphia.
Cook Mfg. Co., The, Paterson, N. J.
Industrial Ovens, Inc., Cleveland, O.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Looms, Wire Weaving
Interlocking Fence Co., Morton, Ill.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany

MACHINERY—Material Handling
(See Material Handling Equipment)

MACHINERY—Measuring Wire & Cable
Davis Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wis.
Entwistle, Jas. L. Co., Providence, R. I.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Baird Machine Co., The, Stratford, Conn.
Glader, Wm., Machine Works, Chicago, Ill.
Meyer, Roth & Pastor Maschinenfabrik (Cosa Corporation, New York, N. Y.), Koln-Raderberg, Germany
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany

MACHINERY—Pickling
Chemsteel Construction Co., Pittsburgh, Pa.
Youngstown Welding & Eng'g Co., Youngstown, Ohio.

MACHINERY—Pin Making
Baird Machine Co., The, Stratford, Conn.

MACHINERY—Pointing
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Meyer, Roth & Pastor Maschinenfabrik (Cosa Corporation, New York, N. Y.), Koln-Raderberg, Germany
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Poultry Wire Fencing
Interlocking Fence Co., Morton, Ill.
Malmedie Maschinenfabrik, Dusseldorf, Germany
Wean Equipment Corp., Cleveland, O.

MACHINERY—Re-Spooling
Boyd & Sons Manufacturing Corp., Philadelphia, Pa.
Davis Electric Co., Wallingford, Conn.
Eisler Engineering Co., Newark, N. J.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Providence, R. I.
National Mach'y Exch. (Used), New York, N. Y.
Steel Equipment Co., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.
Wire Insulating Machy., Div. of Machinery Electrification, Inc., Worcester, Mass.

MACHINERY—Rod Mill
Morgan Construction Co., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Rolling Mill
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Rubber Insulating
Davis-Standard Sales Corp., Mystic, Conn.
Royle, John & Sons, Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Spark Testing
Davis Electric Co., Wallingford, Conn.
Entwistle, Jas. L. Co., Providence, R. I.
Federal Manufacturing Co., Wallingford, Conn.
Peschel Electronics, Inc., New Rochelle, N. Y.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Spring Making
Carlson Company, The, New York, N. Y.
Lundahl Corp., Winsted, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany
Wells, Frank L., Co., Kenosha, Wisc.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany.

MACHINERY—Straightening & Cutting
Kilmer, M. D., & Co., Cleveland, Ohio
Lewis Machine Co., The, Cleveland, Ohio
Medart Co., The, St. Louis, Mo.
Mettler Machine Tool Co., New Haven, Conn.
Meyer, Roth & Pastor Maschinenfabrik (Cosa Corporation, New York, N. Y.), Koln-Raderberg, Germany
National Mach'y Exch. (Used), New York, N. Y.
Wells, Frank L., Co., Kenosha, Wisc.

MACHINERY—Stranding
Haskell-Dawes Machine Co., Philadelphia, Pa.
Hughesville Machine & Tool Co., Hughesville, Pa.
Maillefer S. A., Renens-Lausanne, Switzerland.
Milton Machine Works, Inc., Milton, Pa.
New England Butt Co., Providence, R. I.
Robinson Manufacturing Co., New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Swaging
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Take-Up and Pay-Out
Aetna-Standard Engineering Co., Pittsburgh, Pa.
American Insulating Mach'y Co., Phila., Pa.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Sales Corp., Mystic, Conn.
Federal Manufacturing Co., Wallingford, Conn.
Industrial Ovens, Inc., Cleveland, Ohio
New York Engineering Co., Yonkers, N. Y.
Robinson Manufacturing Co., New York, N. Y.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.
Wire Insulating Machy., Div. of Machinery Electrification, Inc., Worcester, Mass.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Ets. Pourtier Frères, Romainville, France
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Testing Magnet Wire Coatings for Pin Holes
Peschel Electronics, Inc., New Rochelle, N. Y.

MACHINERY—Testing, Physical
Lundahl Corp., Winsted, Conn.
Scott Testers, Inc., Providence, R. I.
Spring Mfgs. Supply Co., Plainville, Conn.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Steel Equipment Co., Cleveland, Ohio
Syncro Machine Co., Perth Amboy, N. J.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill, Cold Drawing
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Cook Manufacturing Co., The, Paterson, N. J.
Davis Electric Co., Wallingford, Conn.
Federal Manufacturing Co., Wallingford, Conn.
Haskell-Dawes Machine Co., Philadelphia, Pa.

MACHINERY—Used
National Machinery Exchange, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.

MACHINERY—for Wire Welding (See WELDERS—Butt and Spot)

MACHINERY—Winding Wire
Eisler Engineering Co., Newark, N. J.
Entwistle, Jas. L., Co., Providence, R. I.
Federal Manufacturing Co., Wallingford, Conn.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.
Wire Insulating Machy., Div. of Machinery Electrification, Inc., Worcester, Mass.

MACHINERY—Wire Bending
Eisler Engineering Co., Newark, N. J.
Kilmer, M. D., & Co., Cleveland, Ohio

MACHINERY—Wire Drawing
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Herborn, Herborn, Germany
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Wire Forming
Baird Machine Co., The, Stratford, Conn.
Kilmer, M. D., & Co., Cleveland, Ohio
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Wire Rope
Milton Machine Works, Inc., Milton, Pa.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wrapping with Paper
Terkelsen Machine Co., Boston, Mass.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem, Rolling & Edging
Wean Equipment Co., Cleveland, Ohio

NAIL TOOLING—Tungsten Carbide
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Wickwire Brothers, Inc., Cortland, N. Y.

NOZZLES—For Extruding Machines
Wire Tool Div., Bridgeport Jig Boring Co., Bridgeport, Conn.

OVENS—Cable Lacquering
American Insulating Mach'y Co., Phila., Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio
Morrison, John R., Industries, Inc., Cleveland, Ohio
Rockwell Co., W. S., Fairfield, Conn.
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

OVENS—Rod Bakers
Carl-Mayer Corp., The, Cleveland, Ohio
Morrison, John R., Industries, Inc., Cleveland, Ohio

OVENS—Welding Rod Coating
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Morrison, John R., Industries, Inc., Cleveland, Ohio

PAINT—Acid Proof
Ceilcote Company, Cleveland, Ohio

PAINT BONDING CHEMICALS—
American Chemical Paint Co., Ambler, Pa.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PAPER—Creped Wrapping
National Waterproof Papers, Inc., Camden, N. J.
Terkelsen Machine Co., Boston, Mass.

PAPER—For Coil Wrapping and Corrosion Prevention
National Waterproof Papers, Inc., Camden, N. J.
Terkelsen Machine Co., Boston, Mass.

PATENT ATTORNEYS—
Lancaster, Allwine & Rommel, Washington, D. C.

PAY-OUT SYSTEMS—(See MACHINERY—Take-Up & Pay-Out)

PHOSPHATE COATING CHEMICALS — (See COMPOUNDS — Phosphate Coating)

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PICKLING—Hooks, etc. Acid Resisting
Youngstown Welding & Eng'g Co., Youngstown, Ohio.

PICKLING TANK LININGS—
Chemsteel Construction Co., Pittsburgh, Pa.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio

PIPES & FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

PLASTICS—for Wire Insulation
Naugatuck Chemical Division of United States Rubber, Naugatuck, Conn.

POTS—Lacquer
Industrial Ovens, Inc., Cleveland, Ohio

PRESSES—Hydraulic and Mechanical
Aetna-Standard Engineering Co., Pittsburgh, Pa.

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry & Mach. Co., Trenton, N. J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio

REEL AND TENSION STANDS—
Davis Electric Co., Wallingford, Conn.
Entwistle, Jas. L. Co., Providence, R. I.
Fidelity Machine Company, Inc., Philadelphia.
Industrial Ovens, Inc., Cleveland, Ohio
Kilmer, M. D., & Co., Cleveland, Ohio
New York Engineering Co., Yonkers, N. Y.
Roll-A-Reel, Cincinnati, Ohio
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire Insulating Machy., Div. of Machinery Electrification, Inc., Worcester, Mass.

REEL CRUTCHES—
Roll-A-Reel, Cincinnati, Ohio
Watson Machine Co., Paterson, N. J.

REELS & SPOOLS—Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Co., Garrett, Ind.
Milton Machine Works, Inc., Milton, Pa.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Garrett, Ind.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio

REELS—Metal Bound
Durkee Mfg. Co., Pine River, Minn.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Garrett, Ind.
McCaskie, Inc., Wm., Westport, Mass.

REELS—Plywood
Carris Reels, Inc., Rutland, Vt.
Hubbard Spool Co., Garrett, Ind.
McCaskie, Inc., Wm., Westport, Mass.
Nelson Company, The, Baltimore, Md.
Winchester Reel Co., Ashuelot, N. H.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

REELS & SPOOLS—Steel (All Types)
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L. Mfg. Co., Rockford, Ill.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Garrett, Ind.
Mason Can Company, East Providence, R. I.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New York Engineering Co., Yonkers, N. Y.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co., Pine River, Minn.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Co., Garrett, Ind.
Mason Can Company, East Providence, R. I.
McCaskie, Inc., Wm., Westport, Mass.
Mettler Machine Tool, Inc., New Haven, Conn.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New York Engineering Co., Yonkers, N. Y.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio
Winchester Reel Co., Ashuelot, N. H.

REELS & SPOOLS—Wooden
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., Inc., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co., Pine River Minn.
Hubbard Spool Co., Garrett, Ind.
Nelson Company, The, Baltimore, Md.
Winchester Reel Co., Ashuelot, N. H.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—(See Ovens—Rod Bakers)

RODS—Stainless Steel
American Steel & Wire Co., Cleveland, Ohio
Pittsburgh Steel Co., Pittsburgh, Pa.

RODS—Wire—Non-Ferrous
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Company, Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
American Steel & Wire Company, Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.

RUBBERS—for Wire Insulation
Naugatuck Chemical Division of United States Rubber, Naugatuck, Conn.

RUST PROOF COMPOUNDS—
(See Compounds—Rust Preventing)

RUST REMOVING COMPOUNDS—
(See Compounds—Rust Preventing)

SALTS—Heat Treating, Descaling, etc.
Holden, A. F., Co., The, Detroit, Mich.

SATURATION SYSTEMS—
Industrial Ovens, Inc., Cleveland, Ohio
New York Engineering Co., Yonkers, N. Y.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

SOAPS—Industrial and Wire Drawing
(See Compounds—Wire Drawing)

SODIUM—for Descaling
du Pont de Nemours & Co., Inc., E. I., Wilmington, Del.
Holden, A. F., Co., The, Detroit, Mich.

SPOOLS—(See Reels & Spools)

SPOOLS—Stamped Metal for Retail Wire Sales
Clark, J. L. Mfg. Co., Rockford, Ill.
Mason Can Co., East Providence, R. I.

STAMPINGS—Steel
Acrometal Products, Inc., Minneapolis, Minn.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Roebling's, John A. Sons Corp., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

TANKS—Compound
New York Engineering Co., Yonkers, N. Y.
Watson Machine Co., Paterson, N. J.

TANKS—Pickling and Plating
Ceilcote Company, Cleveland, Ohio
Chemstrel Construction Co., Pittsburgh, Pa.

TESTERS — INSULATION (See MACHINERY—Spark Testers)

TESTING EQUIPMENT (See MACHINERY Testing, Physical and Diameter Testing)

TESTING EQUIPMENT—Springs
Spring Mfgs. Supply Co., Plainville, Conn.

TINNING PROCESS—
Metal & Thermit Corp., New York, N. Y.

TINSEL—Electric Conductor
Montgomery Co., The Windsor Locks, Conn.

TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper, Silver and False Gold Coated, etc. (See TINSEL—Electric Conductor)

TOOLS—Nail Machine
Pittsburgh Carbide Die Co., Monongahela, Pa.

TOOLS—Spring Forming
Lundahl Corp., Winsted, Conn.
Spring Mfgs. Supply Co., Plainville, Conn.

TOOLS—Wire Cutting
Porter, H. K. Inc., Somerville, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRANSMISSIONS—Variable speed (See Machy—Power Transmission)

TRAVERSES & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Apco Mossberg Co., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.
Wire Insulating Machy., Div. of Machinery Electrification, Inc., Worcester, Mass.

TUBE BENDERS AND FORMERS—
Kilmer, M. D., & Co., Cleveland, Ohio

VALVES & FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

VARNISHES—for Electric Wire
N. E. Lacquer Co., E. Providence, R. I.

VULCANIZING PANS AND EQUIPMENT—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire Insulating Machy., Div. of Machinery Electrification, Inc., Worcester, Mass.

WELDERS—Spot and Butt
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.

WIRE—Aluminum
Elmet Division, North American Philips Company, Inc., Lewiston, Maine
Malin & Co., The, Cleveland, Ohio
Seneca Wire & Manufacturing Co., Fostoria, O.

WIRE—Barbed
Interlocking Fence Co., Morton, Ill.

WIRE—Brass
Chase Brass & Copper Co., Waterbury, Conn.
Spencer Wire Corp., Union, N. J.

WIRE—Brush
Spencer Wire Corp., Union, N. J.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Cold Heading
American Steel & Wire Co., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.
Seneca Wire & Manufacturing Co., Fostoria, O.
Wickwire Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Copper
Chase Brass & Copper Co., Waterbury, Conn.
Spencer Wire Corp., Union, N. J.
Sylvania Electric Products, Inc., New York, N. Y.

WIRE—COPPER, Nickel Clad
Sylvania Electric Products, Inc., New York, N. Y.

WIRE—Flat, Fine
Elmet Division, North American Philips Company, Inc., Lewiston, Maine
Montgomery Co., The, Windsor Locks, Conn.

WIRE—Forming
Pittsburgh Cut Wire Co., Pittsburgh, Pa.

WIRE—Galvanized
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Wickwire Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—High Temperature, Electric
Sylvania Electric Products, Inc., New York, N. Y.

WIRE—Manufacturers
American Steel & Wire Co., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Continental Steel Corp., Kokomo, Ind.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Johnson Steel & Wire Co., Worcester, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Lock Washer Company, The, Newark, N. J.
North American Philips Co., Inc., Elmet Division, Lewiston, Me.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Seneca Wire & Manufacturing Co., Fostoria, O.
Spencer Wire Corp., Union, N. J.
U. S. Steel Co., N. Y., N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Music
American Steel & Wire Co., Cleveland, Ohio
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., The, Cleveland, Ohio
Seneca Wire & Manufacturing Co., Fostoria, O.
Spencer Wire Corp., Union, N. J.

WIRE—Nickel Silver and Phosphor Bronze
Chase Brass & Copper Co., Waterbury, Conn.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Malin & Co., The, Cleveland, Ohio

WIRE—Oil Tempered
Pittsburgh Steel Co., Pittsburgh, Pa.

WIRE—Special Shapes
Charter Wire, Inc., Milwaukee, Wisc.
Continental Steel Corp., Kokomo, Ind.
National Lock Washer Company, The, Newark, N. J.

WIRE—Spring
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Seneca Wire & Mfg. Co., Fostoria, Ohio
Wickwire Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Steel & Wire Co., Cleveland, Ohio
Firth Sterling, Inc., Pittsburgh, Pa.
National Lock Washer Company, The, Newark, N. J.
Pittsburgh Steel Co., Pittsburgh, Pa.

WIRE—Steel—Also Coppered and Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Seneca Wire & Mfg. Co., Fostoria, Ohio
Spencer Wire Corp., Union, N. J.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O

WIRE—Straightening and Cutting
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Tungsten
North American Philips Co., Inc., Elmet Division, Lewiston, Me.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WRAPPING PAPER—Creped (See PAPER—Creped Wrapping)

YARNS & TAPES—
Celanese Corporation of America, New York, N. Y.
Glass Fibers, Inc., Toledo, Ohio
Heineman Corp., Oscar, Chicago, Ill.

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

The WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON 3, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE
AND MASTICATING MACHINERY MANUFACTURERS

WATSON

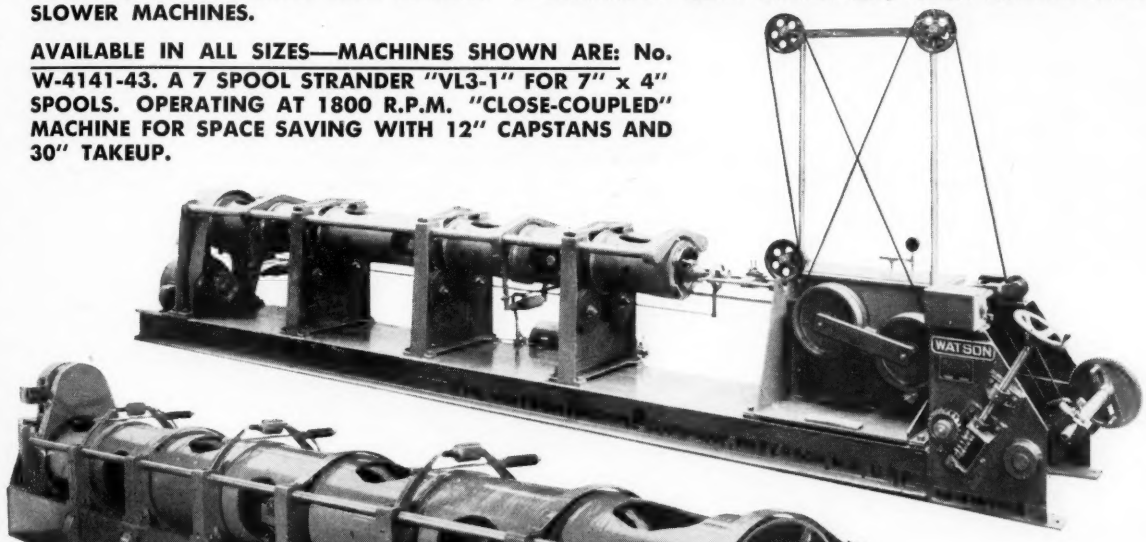
EXTRA HIGH SPEED "VL" TYPE STRANDERS

U.S. PATENTS 2,270,093 & 2,442,817. OTHERS PENDING & ALLOWED

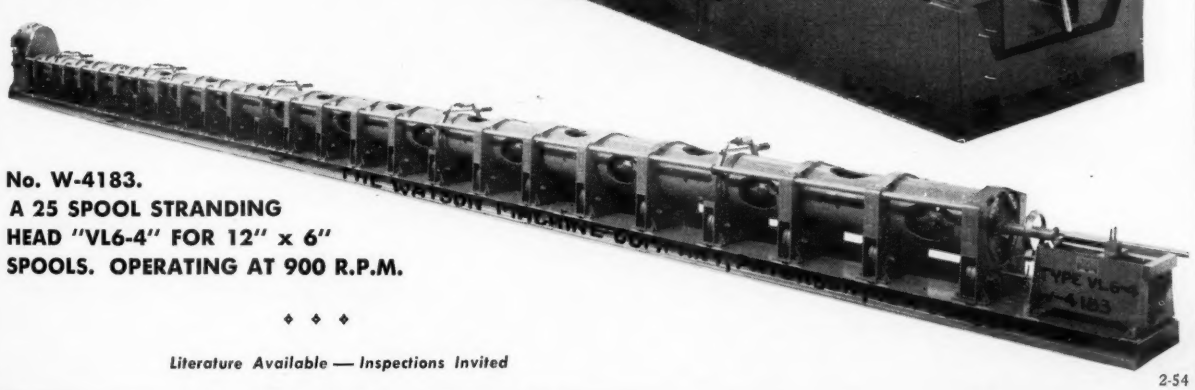
THIS LATEST PATENTED DESIGN COMBINES HIGHEST POSSIBLE MACHINE SPEEDS AND LOADING TIME REDUCTION, RESULTING IN MACHINE UNITS OF UNPARALLELED PRODUCTIVITY.

OUTSTANDING ADVANTAGES OF THIS OVER OTHER DESIGNS ARE: 1—"SHAFTLESS" SELF-LOCKING PATENT BOAT CRADLES WITH INTEGRAL TENSIONS—NO LOOSE PARTS WHATSOEVER. 2—LOWER WIRE AND CORE LEAD ANGLES. 3—EXTREMELY QUIET OPERATION, MUCH QUIETER THAN SLOWER MACHINES.

AVAILABLE IN ALL SIZES—MACHINES SHOWN ARE: No. W-4141-43. A 7 SPOOL STRANDER "VL3-1" FOR 7" x 4" SPOOLS. OPERATING AT 1800 R.P.M. "CLOSE-COUPLED" MACHINE FOR SPACE SAVING WITH 12" CAPSTANS AND 30" TAKEUP.



No. W-3997. A 7 SPOOL STRANDING HEAD "VL9-1" FOR 22" x 11" SPOOLS. OPERATING AT 700 R.P.M.



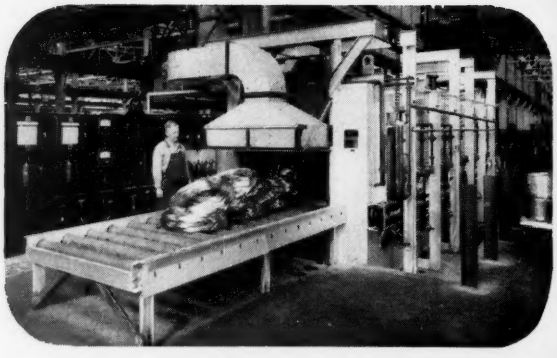
No. W-4183. A 25 SPOOL STRANDING HEAD "VL6-4" FOR 12" x 6" SPOOLS. OPERATING AT 900 R.P.M.

♦ ♦ ♦

Literature Available — Inspections Invited

2-54

These combination electric and gas fired radiant tube bulkhead tray type furnaces are used extensively for bright annealing wire on reels and in coils.



An EF gas fired three-chamber roller hearth with forced circulating system providing accurate temperature distribution, uniform finish and anneal — continuously.

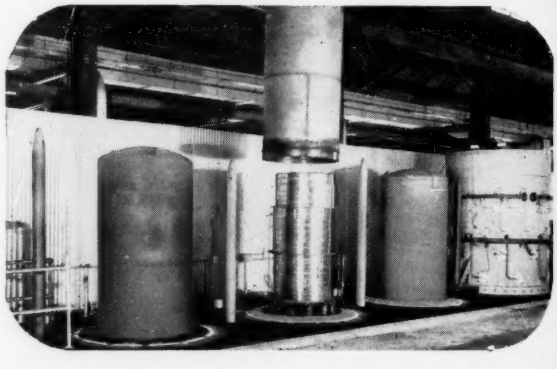
INVESTIGATE EF DEVELOPMENTS

Clean annealing nickel-silver and other alloy wire in an EF gas fired radiant tube continuous roller hearth furnace. Handles coils up to 30" in diameter.

Wire bars up to 66" in length are uniformly and scale-free heated for rolling in this EF gas fired continuous pusher type furnace. Capacity 12,000 lbs. per hour.

FOR EVERY Annealing, Heating or Heat Treating PROCESS

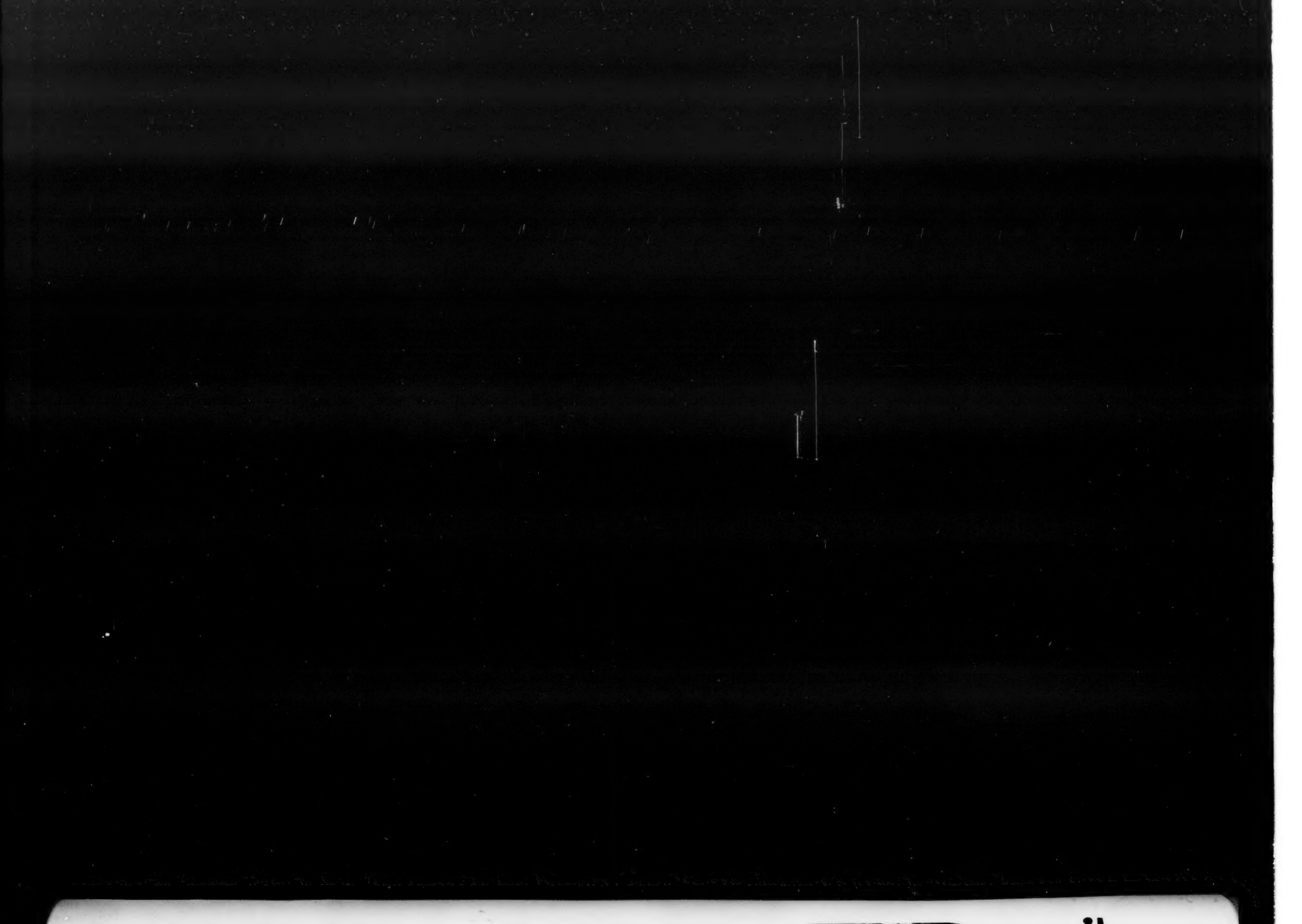
• We have made outstanding production installations for normalizing rod and bright annealing wire in coil, strands, on reels and spools; both ferrous and non-ferrous, including stainless—for heat treating bolts, springs and other wire products—for heating billets, wire bars, bluing nails and other heating and heat treating processes. We solicit your furnace inquiries.



EF gas fired and electric hood, pit and other batch and continuous type furnaces are available for normalizing rod, annealing wire, strip and other processes.

THE ELECTRIC FURNACE CO.

GAS FIRED, OIL FIRED AND ELECTRIC FURNACES FOR ANY PROCESS, PRODUCT OR PRODUCTION

Salem - Ohio

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